HISTORY AND MANUFACTURE OF FLOOR COVERINGS

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THE CARPET AND UPHOLSTERY TRADE REVIEW is the oldest, most important and influential publication devoted to the carpet, upholstery and kindred trades. It is published semi-monthly, these fortnightly editions furnishing the readers with the latest trade news, general reviews of the markets and all other information requisite for a clear understanding of the trade situation and outlook.

A prominent feature of THE REVIEW is the large amount of high class, continuous advertising patronage accorded to it, a fact which speaks volumes for the profitable results secured by its advertisers.

Its large circulation has been attained by many years of conservative, reliable management, and to the manufacturer and dealer alike its semi-monthly visits are as welcome as they are essential.

PREFACE.

THE PURPOSE of this book is to present concisely, yet comprehensively, such information regarding the history and technique of the trade in floor coverings as is desirable and necessary for those who are engaged in the making or selling of these goods. The necessity for this handbook must be obvious, for there is no similar work in existence. Articles relating to various branches of the industry have appeared occasionally in THE REVIEW, but this work is the first in which the subject is handled in a systematic and fairly comprehensive manner, the compiler's idea being to give the more salient facts, avoiding as far as possible purely technical terms or unessential details.

To those who know little or nothing of the technique of the trade the illustrated explanation of the principle of the loom, on pages 89 and 90, and following this the Carpet Cyclopedia, will perhaps be especially useful, presenting as they do the general theory of weaving and brief definitions of the technical terms most used in the art, so far as it relates to floor covering manufacture.

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THEIR

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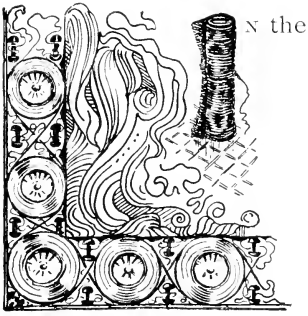
CHAPTER I.

CARPETING IN ANTIQUITY.



N the most ancient times known in history, when the arts highest in favor among the inhabitants of this globe, our amiable ancestors, were those which helped men of one tribe to murder or rob members of another, but little thought was bestowed upon the matter of floor coverings. In the earliest huts, caves or tents the only attempt toward a carpeting consisted in strewing leaves of trees or grass, &c., over the ground. The next advance beyond such primitive expedients was in the use of animal skins. Later, with the progress of civilization and the growth of wealth and luxury, came floorings of variously colored wood, marbles and encaustic tiles. In ancient Greece and Rome mosaics of marble and artificial stone were used in the temples and in the houses of the rich.

Textile carpets were first made in Asia, and were in use there at a time when Europe was inhabited only by savages. The ancient Egyptians made carpets of wool, and the woolen carpets of Babylon were well known at Rome during the second century.

The Oriental looms of antiquity were in all essential respects the same as those upon which rugs and carpets are now woven in all the countries of the Orient, where carpet weaving is still done by hand labor, and, as is well known in the trade, the best product of these early looms has never been equaled by modern goods—so far as durability and beauty are concerned.

Carpets were introduced into Spain at the time of the Moorish conquest of that country, and the Crusaders brought some Turkish carpets with them when they returned from the Holy Land. Italy received most of these goods, and they were dealt in by the enterprising Italian merchants long before they became known in many other parts of Europe.

Mosaic floor coverings were introduced into Britain by the Romans. Planks of oak and deal came into use in Europe during the Middle Ages, and parquetry, composed of squares and lozenges of wood, found some favor among the wealthier classes. In the British Isles the earthen floors, seen even in the best houses of those times, were covered with rushes, hay or leaves. The weaving of these rushes to form a matting was a natural advance suggested perhaps by importations of Chinese and Indian matting. The weaving of straw matting was an art common in China thousands of years ago.

Long before textile carpets were known in Europe the noble ladies of England, Flanders and other European countries were accustomed to spend much of their time in

the making of tapestry or needle-work hangings for walls, and occasionally these fabrics were employed also as carpets. In the fourteenth century this work, until then a feminine accomplishment, was taken up as a trade. A factory was established for this purpose at Arras, in Flanders, and the manufacture soon spread to France and other parts of Europe. The materials employed in these goods were woolen yarns and threads of silk, silver and gold. In 1607 Henry IV. of France established a factory at the Louvre for the making of wall hangings and carpets. The carpeting made was called Turkey stitch (point de Turquii). In 1627 the carpet factory known as the Savonnerie was established in a building at Chaillot which had previously been used as a soap factory.

In an ancient romance there is reference to carpets which were made at Limoges, France, in the twelfth century, and a hundred years later the making of carpets was the daily work of the monks in the convent of Lilbe, Westphalia, but these goods were embroidered, not woven. The mediæval church in Europe employed Oriental carpets and rugs before altars, in the choirs of cathedrals and at the feet of images. Carpets mounted on poles were carried in religious processions as canopies over the Host or great dignitaries of the church. The troubadours and jugglers gave their performances on carpets. Ladies ornamented their presence chambers with carpets and used them as hangings for private oratories. They were laid before thrones and at state banquets. In the pictures of the old Dutch school the table covers were frequently Oriental carpets, and they were largely used in this way in the Netherlands and other European countries. In the second edition of Bailey's Dictionarium Britannicum, published in 1736, a carpet is defined as a table cover, while in the

twenty-first edition, published in 1766, it is described as a covering for a table, passageway or floor.

In the goods made at the Louvre and the Savonnerie in the early part of the eighteenth century the weavers used a combination of the loom and a shuttle needle, in which the latter formed the pattern, the general effect being similar to needlework. In 1664 Colbert, minister of Louis XIV., established a carpet factory at Beauvais. The carpet workshops of the Louvre and the Savonnerie were reorganized by Louis XIV., and some of the most famous painters of his time were engaged to supply designs for the weavers. A few of the carpets of this period still survive. Their ornamentation consists of large scrolls of acanthus leaf, combined with flowers and moldings encircling groundwork of various colors or medallions representing figures in cameos or landscapes. The Gobelins Museum has a carpet of the time of Louis XII. It bears on its face a representation of that king, his queen, Anne of Austria, and their two children.

A large proportion of the workmen employed in the French factories were of Flemish birth or descent, and Protestants; while among the French themselves, under the protection of the Edict of Nantes, the number of Protestants had greatly increased, especially in the class of skilled artisans. The revocation of the edict in 1685 resulted in the flight of many thousands of these workmen from France to countries where they were not liable to persecution on account of their religious faith. Flanders, Holland and England received many of these fugitives.

Flanders was the first country in Europe to engage in the weaving of carpeting on looms of a distinctly European pattern, as compared with the primitive apparatus used by

the Oriental weavers. Brussels carpeting was a prominent product of Flemish looms, as was also a kind of velvet pile carpets, also woven entirely, the pattern being brought out by the shortening of the weft threads and the interlacing of the warp quite across the web.

CHAPTER II.

Carpet Making in Great Britain.

As early as the reign of Edward III. a number of Flemish weavers settled at Bristol, England, and began the manufacture of a floor covering which became known as Bristol carpet. It was similar to the Scotch or Kidderminster carpeting of a slightly later date.

In the reign of Henry VIII. an unsuccessful attempt to manufacture carpets was made by William Sheldon, and under James I., who took much interest in the enterprise, a factory was established at Mortlake, in Surrey, for the manufacture of carpeting and tapestry; but the amount of goods produced was small, and the English carpet industry did not become of any material importance until 1685, when the French and Flemish weavers were forced to flee from France into England by the intolerant and short-sighted policy of Louis XIV.

Before 1745 most English carpets were a mere interlacing of warp and weft of different colors, and dornix, a sort of linsey-woolsey cloth. In 1735 the manufacture of Kidderminster carpeting had become a notable industry in the town of that name. In 1745 a carpet factory was established at Wilton, England, under the patronage of the Earl of Pembroke, who while traveling in France had noted the superiority of the French in this industry, and determined to introduce their methods into his own country. He accordingly imported a number of French weavers, and

secured a patent giving him the exclusive privilege of manufacturing these French carpets in England. They were made in one piece, either square or oblong, and had a cut pile like the Oriental goods. Four years later some Kidderminster manufacturers began to make carpets like these goods, then known as Wiltons. The patent granted for the Wilton goods, among other particulars, specified that the fabric was made with "bobbin and anchor," but the Kidderminster manufacturers erected looms on essentially the same principles, the only difference being the use of "bobbin and ball," instead of "bobbin and anchor."

Besides the carpet factory at Wilton, the Earl of Pembroke established also works for the manufacture of marble cloth, which was a kind of floor cloth.

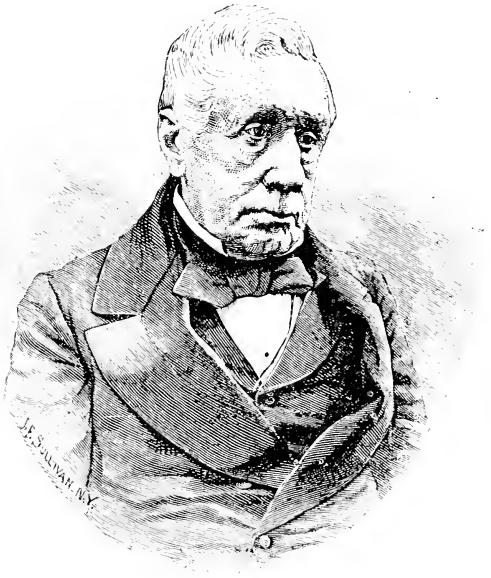
In 1750 a Capuchin friar began the manufacture of Savonnerie carpets at Fulham, England. The enterprise was unsuccessful, but at London in the same year two workmen who had been employed in the Savonnerie factory opened a workshop with the assistance of a Mr. Moore. A disagreement between the three men resulted in the starting of another shop by the two Frenchmen in partnership with one Parisot, and under the patronage of the Duke of Cumberland. Moore's factory continued in operation, and in 1757 he obtained a premium from the Society of Arts for the production of the best imitation of a Turkey carpet.

The manufacture of what is known as Brussels carpets probably originated in Flanders. The city of Brussels was noted for the product of these goods, and gave its name to them; but they were also made at several other places in Flanders. Their manufacture was introduced into England by John Broom, a Kidderminster weaver, who went to Brussels and afterward to Tournai to study

the method of weaving the goods. At Tournai, Broom found a man who understood the making of the Brussels loom, and the two men embarked together for England, where in 1749 they built and set in operation the first Brussels loom known in that country. Broom and his assistant were anxious to keep to themselves the secret of the Flemish loom, and no other man was allowed to enter their workshop; but they ran the loom by night as well as by day, and finally a weaver in the employ of another Kidderminster carpet maker discovered the principle of the machine by climbing a ladder night after night and watching the two weavers while they thought they were unobserved. In a short time Kidderminster had a number of Brussels looms in operation, and the town eventually became the chief seat of this particular branch of the carpet industry.

In the year 1831 an invention of the highest importance to the carpet trade was accomplished by Richard Whytock, of Edinburgh, Scotland. Mr Whytock was the head of the firm of Richard Whytock & Co., manufacturers, jobbers and retail dealers in carpeting, at Edinburgh. His experience as a retail dealer as well as a manufacturer had convinced him that a carpet differing from Ingrain, but cheaper than Brussels, would be in demand among that large portion of the public which could not afford the purchase of Brussels. Pondering upon this idea it occurred to him that a one-frame Brussels would be just the fabric desired, because it would save all the usual waste of valuable material in the weaving of Brussels, a loss entailed by the fact that in such weaving the greater part of the worsted went to the back of the fabric where it was practically useless. With this idea in view he began in 1830 his experiments in the making of the new fabric. In his em-

ploy at that time was William Sloane, who afterward came to New York and founded here the great carpet business now conducted under the style of W. & J. Sloane. Mr. Sloane procured for Mr. Whytock at Kilmarnock the first jars of coloring matter used in the dyeing of the



RICHARD WHYTOCK.

yarn. Being now convinced that the idea was practicable Mr. Whytock began to print a warp for weaving. As no patent had then been secured by him he desired to keep the invention private, and the first loom for the weaving of the fabric now known as Tapestry or Tapestry Brussels was set up in a stable loft in the rear of Whytock & Co.'s

warehouse. The first entire piece of Velvet carpet made was woven on this loom by William Sloane in the year 1831.

Soon afterward Mr. Whytock obtained a patent for his invention, and an arrangement for the manufacture of the goods was made with the firm of Pardoe, Hooman & Co., of Kidderminster, England, who were then the largest manufacturers of Brussels carpeting in England. They intended to manufacture the new fabric on an extensive scale, and believed that they could improve Mr. Whytock's method of printing the yarn, but after experimenting for a considerable time and incurring heavy expenses in consequence, they found the result unsatisfactory and finally abandoned the scheme in disgust. One or two other manufacturers attempted to make the goods, but were also unsuccessful.

Although somewhat discouraged by these failures, Mr. Whytock kept a few looms running to supply the retail trade of his own firm, and the goods gradually gained a small degree of favor with the public, but it was not until they were introduced into the United States, in 1843, that the demand for them assumed large proportions. Soon afterward the English carpet manufacturing firm of John Crossley & Sons became the owners of the patent, and by making important improvements in the styles of designs and colorings and the quality of the fabric speedily secured for it a wide popularity, especially in the United States.

Mention has been made of the manufacture of imitation Turkey carpets in England at Moore's factory. About the middle of the eighteenth century similar goods were produced by several English manufacturers, and especially at Axminster. The fabric soon became known as Axminster, but the demand for it has always been limited on account of its expensive character. It is made almost

entirely of fine wool for both front and back, the wool being knotted in tufts upon the warp threads by the hand of the workman, and held together by an invisible groundwork of linen thread.

A desire to produce a fabric which, although less expensive, would preserve in fair measure the rich effect of a genuine Axminster prompted experiments by James Templeton, of Glasgow, and William Quigley, of Paisley, Scotland, which resulted in 1839 in the invention of the carpeting called patent Axminster. Mr. Templeton was a member of the carpet manufacturing firm of James Templeton & Co., Glasgow, and John Templeton, a member of the firm, devised several improvements in the fabric, with which this house has ever since been most prominently identified. The salient feature of patent Axminster manufacture is a species of double weaving, by which strips of chenille employed as woof are arranged in accurately defined patterns, and a heavy velvet piled carpeting is produced with a hard linen back instead of the soft woolen back of the original Axminsters. The patented goods are cheaper, partly on account of the use of steam power, but mainly because they require only about half the wool used in the real Axminster.

CHAPTER III.

The Carpet Industry in the United States.

In this country 100 years ago the only woven covering for floors in use to any material extent was the domestic rag carpet. All other textile floor coverings were imported, for it was the policy of the British Government at that time to discourage and, in fact, repress every colonial industry which seemed to threaten competition with the British manufacturers at home. The carpeting imported consisted mainly of Scots or Kidderminster Ingrains. In 1760 J. Alexander & Co., whose store was on Smith street, New York city, advertised in the New York Gazette that they had some Scots carpets for sale, and in the following year they announced through the same newspaper that they had added Turkey carpets to their stock.

All imported carpeting was expensive in those days, and the Turkey hand-made goods were especially dear. Such floor coverings were regarded as luxuries to be indulged in only by wealthy people, and the rich were then exceedingly small in number. Even such modest floor coverings as rag carpets were used only in the best room of the average house. For the bed chamber the bare floor or perhaps a bedside strip of rag carpet was thought good enough, and in houses where the kitchen was used also as a sitting room some thrifty housewives used no other floor covering than sand, which was strewn around, as is still the custom in some barrooms and country

hotels. It was not uncommon for the Dutch housewife of New York or New Jersey to use sand even in the best room, and if of an æsthetic turn of mind she might gratify her decorative instincts by arranging the sand in designs simple or intricate. These home-made patterns had the great advantage of being open to change as often as might be desired.

The first carpet factory operated in the United States was established at Philadelphia in 1791 by William Peter Sprague. Among Mr. Sprague's earliest products was an Axminster carpet in which the pattern represented the arms and achievements of the United States. This factory attracted the attention of Alexander Hamilton and induced him to recommend the imposition of a small duty on foreign carpeting as an encouragement for domestic manufacturers.

Soon after Mr. Sprague established his factory, several others were started on a small scale at Philadelphia and elsewhere for the manufacture of Ingrains and Venetians. In 1804 Peter and Ebenezer Stowell opened a factory at Worcester, Mass., where they had in operation six looms of their own invention and construction. In 1810 George W. Conradt, who came from Wurtemberg, Germany, entered into the manufacture of Ingrains at Frederick City, Md. Mr. Conradt's carpeting was made on the old barrel loom, which required a separate barrel for each pattern. The barrel was studded with pins somewhat like the cylinder of a music box, and in rotating the pins acted on the warp threads. The application of the barrel machine to carpet weaving was first effected by Thomas Morton, a Scotch weaver, who afterward came to the United States and plied his trade in Connecticut. In 1801 Jacquard invented the famous device which was des-

tined to supersede the barrel machine and all other methods of figure weaving, but the Jacquard attachment was not adapted for use on carpet looms until several years later. According to the census of 1810 only 9,984 yards of carpet and coverlid were made in this country in that year.

In 1821 John and Nicholas Haight started a factory in New York city. Their mill superintendent was James W. Mitchell, a Scotchman from Kilmarnock, which was then the principal seat of Ingrain manufacture in Scotland. In 1825 Alexander Wright started a small carpet factory at Medway, Mass., but it was not successful, and in 1828 the plant was bought by the Lowell Manufacturing Company, which had been organized in that year for the manufacture of cotton goods and carpeting at Lowell, Mass. This was the beginning of the great carpet manufacturing business of the Lowell Company.

The first adaptation of the Jacquard machine to carpet weaving in this country was made in the Lowell mill soon afterward by Claude Wilson, one of its employees. To accomplish this purpose it was necessary to make several changes in Jacquard's device, and since then some other and important modifications of it have been made to render it more effective in the weaving of carpets.

But the Lowell mill was destined to become the scene of a far more important event, one which marked a new epoch in the history of carpet manufacture, for it was in this mill that the great inventor, Erastus B. Bigelow, perfected the first loom ever made for weaving carpets by power not depending on human muscles.

Bigelow began experimental work on his power Ingrain loom in 1839, but the invention was not perfected until about two years later. The experiments essential were costly and the inventor was a poor man, but he was for-

tunate in enlisting the interest of George W. Lyman, then treasurer of the Lowell Company, and father of Arthur T. Lyman, who is its present treasurer. George Lyman, a sagacious, far-sighted business man, quickly recognized the importance of the invention, and, having

ERASTUS B. BIGELOW.

the courage of his convictions, he influenced the company to advance money for the making of the new looms, and also for the building of a large mill for them, several hundred thousand dollars being thus invested.

The chief difficulty in the weaving of Ingrains on the power loom was in the matching of the figures. The hand-loom weaver accomplished this by a careful regula-

tion of the tension of the warps and beat of the lay, but to make automatic machinery perform the work as well seemed impossible until Bigelow's inventive genius was directed to the task. His first loom turned out carpeting in every way superior to the fabric made by hand looms, but the product per day, was not much greater, the hand loom making 8 yards a day, while the automatic machine produced only 4 more yards in the same time. Not being satisfied with this result, Mr. Bigelow continued his experiments, and in 1841 succeeded in increasing the product to from 25 to 27 yards a day.

At this time carpet manufacture in the United States was an infant industry in every sense of that term. The factories then in operation in Massachusetts were seven in number. In Connecticut four were running; New York had eight; four were situated in New Jersey. In Pennsylvania there were five, all of which were in or near Philadelphia, and Maryland had one. The principal mills were: The Lowell Company's 150 looms; William H. McKnight's, Saxonville, Mass., 150 looms; Orrin Thompson's, at Thompsonville and Tariffville, Conn., 250 looms, and W. H. Chatham's, Philadelphia, 160 looms. Among the mills in operation were the first plants of several of the largest concerns now in the trade, including, besides the Lowell Company, those now known as the Hartford Carpet Company, Robert Beattie & Sons, the E. S. Higgins Carpet Company and McCallum & McCallum. The total number of looms in operation in 1841 did not much exceed 1,500, and about 1,250 of them were used for Ingrains, the others being devoted to Brussels, Damasks, Venetians or rugs.

But the industry was soon to receive new and great impetus. In 1848 Mr. Bigelow turned his attention to the

construction of a power loom for Brussels carpeting, and the invention was soon perfected, its salient features being adapted from a loom invented by Mr. Bigelow several years previous for the weaving of coach lace. But although the new Brussels loom was a success in operation, the inventor was unable to make satisfactory arrangements with any carpet manufacturer for its utilization, and he was finally obliged to invest some of his own money in the establishment of a Brussels mill at Clinton, Mass., which was the nucleus of the present great plant of the Bigelow Carpet Company.

The manufacture of Tapestry Brussels and Velvet carpeting in the United States was first undertaken in 1846 by John Johnson, who came to this country from Halifax, England, where he had been in the employ of John Crossley & Sons. Mr. Johnson opened a Tapestry mill at Newark, N. J., with twenty-five looms. The plant was subsequently removed to Troy, N. Y., and in 1855 was purchased by a company headed by Michael H. Simpson and removed to Roxbury, Mass. The Roxbury Carpet Company, as this concern was called, under the lead of President Simpson soon became and continues to be one of the most important factors in the Tapestry and Velvet trade of this country.

The product of Johnson's Tapestry looms was about 5 yards a day. In 1856 the product of each loom run by the Roxbury Carpet Company was 16 yards a day, and at present the average Tapestry loom turns out about 60 yards a day, and a product of 65 yards is not unusual. The great increase in production was effected first by the application of Mr. Bigelow's invention for power weaving to the Tapestry loom, and later by various improvements in the wire motion and other features of the loom.

In the year 1876 another invention of great importance to the carpet trade, the power loom for making Moquette carpeting, was effected by Halcyon Skinner, who was then

HALCYON SKINNER.

in the employ of Alexander Smith, founder of the great manufacturing concern now known as the Alexander Smith & Sons Carpet Company. About twenty years previous Mr. Smith, who was then making carpeting in a

factory at West Farms, N. Y., conceived the idea of weaving Axminster or tufted carpets on a power loom. Having recognized in Mr. Skinner a mechanic of far more than ordinary talent and originality, Mr. Smith employed him to devise the loom, and about a year later one was constructed and patented. It proved unsatisfactory, but in 1860 another was built and this was found to answer the purpose perfectly. But soon afterward the factory at West Farms was destroyed by fire, and although the new loom was saved it became necessary to build another mill, and in the meantime Mr. Smith's attention was directed to other interests. In 1864 he closed his factory at West Farms and opened one at Yonkers, N. Y., where he engaged at first in Ingrain manufacture and subsequently in the making of Tapestry Brussels on an extensive scale. Mr. Skinner continued in the employ of Mr. Smith as a mechanical expert, and during this time he invented important improvements in Ingrain looms, and also in the machinery for Tapestry Brussels manufacture. In 1876, at the suggestion of Mr. Smith, he began work on a power loom intended for the weaving of Moquette carpeting, and in January, 1877, the first or ground patent for the loom was granted. Since then many other patents have been obtained for improvements on the original loom. Some of these changes were made by Halcyon Skinner, and others were invented by his sons, Charles and A. L. Skinner. The ground patent for the Moquette loom expired January 17, 1894. Several later and important patents for improvements of the fabric and loom still survive, and are also controlled by the Alexander Smith & Sons Carpet Company, but American "Axminsters," goods made on power looms and very closely related to the Moquette weave, are now produced by several other manufacturing concerns.

Among more recent improvements in carpet manufacture perhaps the most interesting is to be credited to James Dunlap, of Philadelphia, whose patented method of printing Tapestry carpeting in the cloth has solved a problem which many manufacturers had struggled with in vain. John Bright, the English statesman and carpet manufacturer, was one of those who attempted the solving, and failed completely, a great deal of money being lost in experiments. Thomas Crossley was more successful, for his Electrotype carpeting, as it was called, was a marketable fabric. His mechanical ingenuity enabled him to overcome difficulties which had baffled previous efforts in the same field, and in a factory established at Ellington, Conn., he produced for a year or two 1,000 yards daily, all of which found a ready sale. But neither he nor his brothers, with whom he was associated, had much business ability, and the enterprise eventually proved disastrous to all concerned in it.

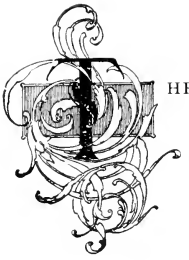
Mr. Dunlap's invention was an improvement as compared with all previous ones for the purpose, in the fact that the coloring in the fabric extended entirely through it. Former devices for printing the cloth had failed to saturate the pile down to the roots, and consequently the color was rubbed off when the tips of the pile were subjected to ordinary wear and tear. Mr. Dunlap overcame this defect by using a peculiar roller, which not only gave a superficial color but also held the dye in cells or depressions, so that when the roller was applied to the carpeting under great pressure the coloring matter was forced down to the roots of the pile and thoroughly saturated them.

Besides the inventions which have been mentioned many others have been highly important factors in the progress of the carpet industry in this country, but reference to

them is postponed for the present. It is sufficient now to note that American ingenuity, enterprise and energy have never been exhibited more prominently and successfully in any industries than in the manufacture of carpeting. From the small beginning of hardly a hundred years ago the industry had attained in 1890 a yearly product valued at about $50,000,000. The number of factories was 173, representing an aggregate capital of $38,208,842, and employing 29,121 persons. These figures, which are from the census of 1890, do not include 854 factories or workshops in which rag carpeting was made, the yearly product of this fabric being valued at $1,714,480.

CHAPTER IV.

Oriental Rugs and Carpets.



The making of Oriental rugs is a simple but slow process, and although it seems easy, it is so only to Orientals themselves, with fingers trained to deft, skillful manipulation and an inherited taste and ability for such work. The loom may be a few trunks of trees and poles bound together in primitive fashion. It is never more than a simple vertical frame, carrying on its upper part a beam containing the warp, which is kept stretched by a pole or rod passing through it. It is usually set up in a rough shed adjoining the house of the weaver, though sometimes in the open.

The weavers, who are the women and girls of the household, sit before the loom and taking the threads of wool, previously prepared and sorted, attach them to the warp by a running knot. They then insert the weft for the back, press the knots home with a wooden comb, and level the pile with a pair of scissors.

Generally each worker has a special piece of the pattern assigned to her. To make a carpet 4½ yards square six women are usually employed, being placed at a distance of 27 inches from one another. On an average each woman weaves daily a piece 8 to 10 inches long and 27 inches wide.

When the work is made merely an avocation, as is so commonly the case, the weaver generally knows the pat-

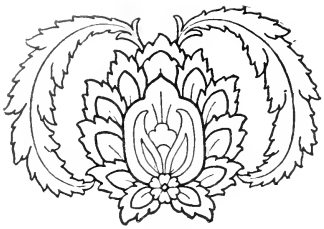


Fig. 1.

Fig. 7.

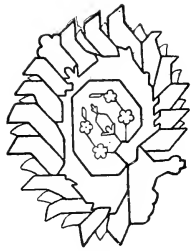


Fig. 3.

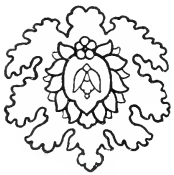


Fig. 2.

Fig. 5.

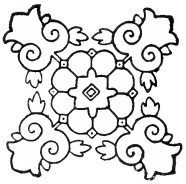


Fig. 8.

Fig. 4.

Fig. 6.

Fig. 10.

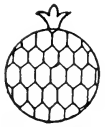


Fig. 11.

Fig. 9.

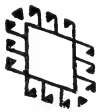


Fig. 12.

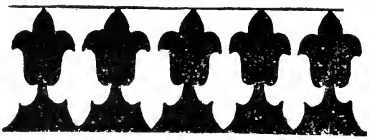


Fig. 16.

Fig. 14.

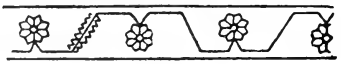


Fig. 15.

Fig. 13.

Fig. 17.

tern by memory and is never at a loss for the right shade. But in places like Oushak, where many weavers are concentrated and have made the work a vocation, new patterns are sometimes required, and then an especially expert weaver is employed in making a pattern carpet from a design, and from this the women work as usual, copying the design from the back of the pattern carpet by counting the knots.

Great care is taken in the preparation of the wool and dyes for the choice grades of rugs. Sheep having especially

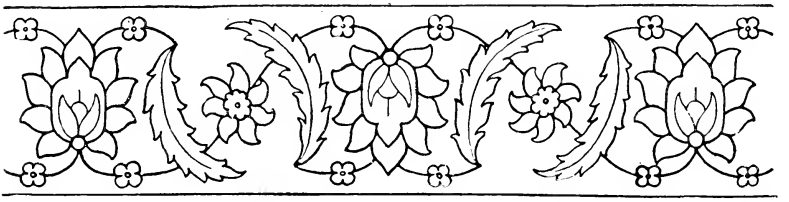
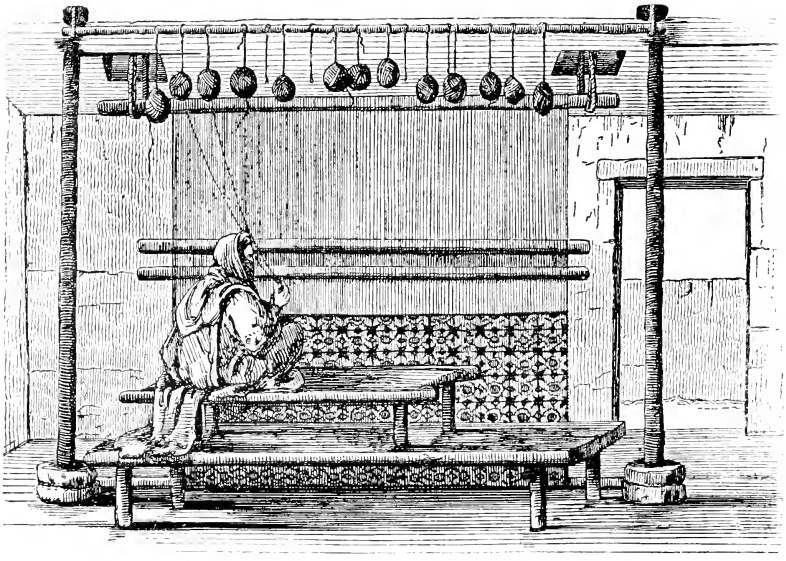


Fig. 18.

good wool are kept housed, and often have linen coverings sewn upon them in order that the wool may remain clean and also because wool treated in this way becomes saturated with animal fat, which makes it soft and glossy. Goat's hair is used to some extent, as there are certain breeds of goats that have supple, glossy hair. Camel's hair is also employed. Silk is rarely used, and scarcely ever in Western Asia. Most of the silk rugs in existence are of antique manufacture. But in the finest rugs silk is sometimes used even in the warp threads, appearing at the end to form the fringe. The wool used is always unbleached and the fat is allowed to remain in it. It is

difficult to dye such greasy wool, but the Orientals do not desire sharp, well defined colors. It is indeed the custom to leave the remains of dyes in the vats or kettles, as this constant blending of colors gives the soft, broken tints which are characteristic of Oriental rugs. Another point



ORIENTAL CARPET LOOM.

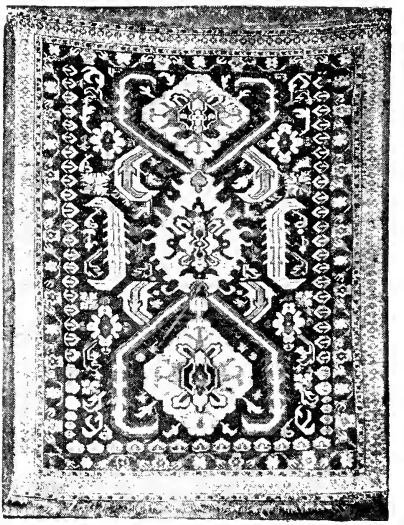
to be borne in mind is that such goods are always dirty. A thorough cleansing will never fail to make the colors brighter and clearer.

The colors most used are indigo, porcelain blue, green, yellow, orange, crimson and rose red. The best wearing colors are the blues, reds and yellows, because they improve with age, while the others are liable to deteriorate.

The dyes used are supposed to be vegetable, but of late years aniline colors have been used largely by some unscrupulous weavers. Aniline colors are handsome at first, but change finally into an ugly gray.

In all Oriental designs for rugs or other textile fabrics certain figures are especially prominent, either in their

GHIORDES RUG.



ANTIQUE MELES RUG.

simplest forms or in combination with others. The palm in various modifications is a favorite "motive." Figures 1, 2, 3, 4 and 5 in the cuts shown herewith, are all based upon the palm. Fig. 1, which is the most elaborate, is found frequently in the antique Persian rugs and carpets. Fig. 2 is common in several Oriental makes. Fig. 3 is an old Persian motive. Fig. 4 is used freely in the modern Ferahan

and Kurdistan carpets. Fig. 5 shows a palm and geometrical figure found in the rugs of the Caucasus. Figs. 6 and 7 are blendings of palm and floral motives seen in many Persian carpets. Figs. 8 and 9, the rosette, Fig. 10, and the pomegranate, Fig. 11, are prominent in several varieties of Oriental rugs. The lozenge, Fig. 12, is the charac-

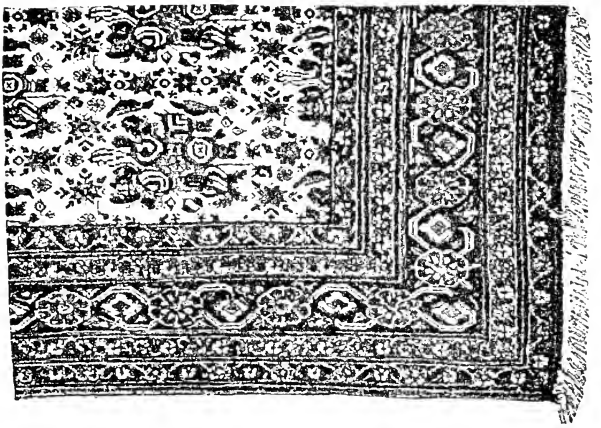
SUMAC RUG.

teristic motive in the rugs made by the nomads of Central Asia. Fig. 13 is Persian. The borders shown in Figs. 14, 15, 16, 17 and 18 are well-known Oriental types, but Fig. 18 is usually found only in Herati carpets or rugs.

In former times the differences between the rugs of the various weaving districts of the Orient were clearly marked, and a glance at the material, design or colorings of a rug would be sufficient to show at once the country,

and in most instances the very district or province, from which it had come.

But at the present day such details as texture or pattern are not always decisive in tracing the origin of a rug of modern manufacture, because in many of the Oriental weaving districts the goods are made for the Western markets under the order and often under the supervision



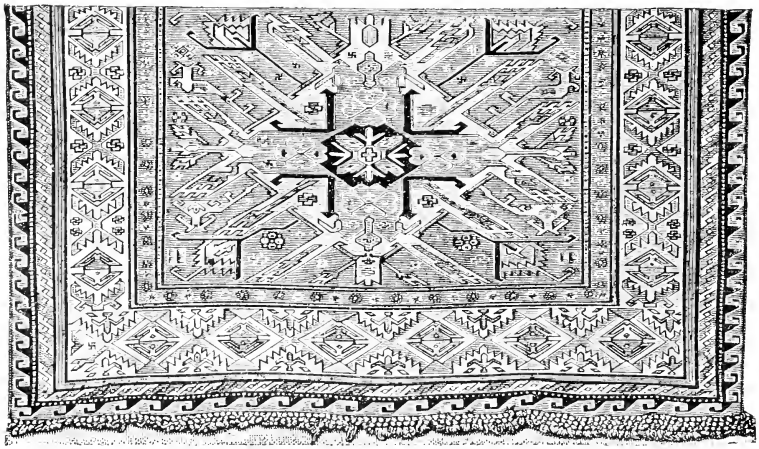
KIRMAN CARPET.

of a European buyer, who allows no native ideas to interfere with his own conception of a handsome and salable pattern. But it should also be said that such goods generally possess all the desirable features of an Oriental make, without the defects often found in those which are made by native weavers to suit themselves.

Of course these remarks do not apply to rugs which are really antique, or to modern goods manufactured in districts in which the weavers are still exempt from the in-

fluence of Western ideas, as in the Caucasus or among the nomad tribes.

But while it is not always safe to be positive as to the exact birthplace of an Oriental rug, it is still true that each rug making country in the Orient has its particular kind of rug, the typical Turkish product, for example,



SUMAC CARPET.

being different from the Persian in both weave and pattern.

Oriental carpets and rugs may be divided into four general classes—Turkish, Persian, Daghestan and Indian. Some experts would say that Indians could hardly be regarded as a separate class. The Turkish goods are looser in texture than the Persians or Indians, but the length of the pile gives them thickness and durability. The designs are a mixture of arabesques, moresques, medallions

and rosettes. The conventionalized flowers used in them are generally tulips, hyacinths and roses. The best known among Turkish rugs are called Oushaks, because they come from the province of that name. Among other prominent makes are the Ghiordes, Koula, Dimirdje, Youroke and Anatolians.

In the Oushak goods the most usual colors are old gold, old red and cream, mingled with blue. The texture is thick and the designs are large, bold figures, as a rule. In Kirmans, which are a finer grade of Oushaks, the patterns are in Persian style, and the Ghiordes rugs also resemble Persians somewhat in designs and colorings. Koula produces a specialty in all wool carpets of primitive make but excellent quality, and also an inferior kind of prayer rug in which are three parts of wool and one of hemp. The antique Ghiordes rugs were made in mosque designs, and rank among the finest Oriental goods. The rugs and carpets now made in Ghiordes are very popular in the European and American markets. They come in all sizes and in Turkish, Indian, Persian and other patterns. The Dimirdje rugs are similar to Ghiordes, but heavier. Meles rugs come in small sizes only and in peculiar brownish red effects. The centres are plain excepting a sort of mosque design, and the edges have a selvage like the Bokhara or Shiraz rugs. The pile is velvety and the wool used is very fine. Youroke rugs have a long pile and come in bright reds and blues with well covered grounds.

The Sumac is woven more closely than the Oushak, and has no pile. The back is shaggy, and has long strands of wool left hanging loosely, as in the Cashmere India shawls. For this reason Sumacs are often, but erroneously, called Cashmeres. The Sumac has a longer fringe than most other rugs, but this may be more or less worn away if the

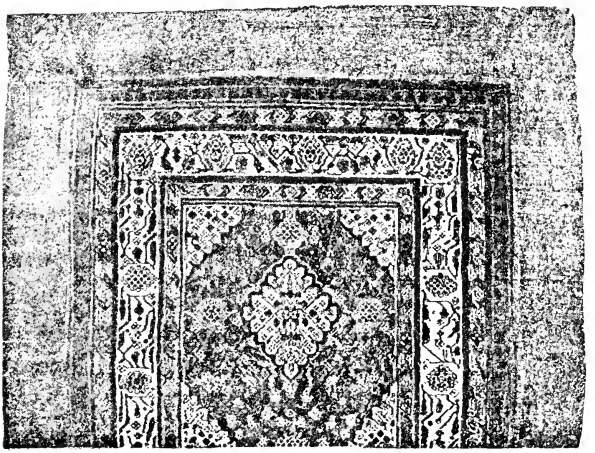
rug is old, and the strands of wool on the back are also liable to be worn off by years of use. The designs are conventional, and generally consist of several large figures in the centre on a background which is almost always a deep rich red, which in an old rug may turn to a soft shade of pink or red. Occasionally one sees a blue or yellow ground. The border almost invariably consists of four lines. The outer edge is 10 inches wide, the design being in black or dark blue on a red ground. Inside the red border is a white band with bits of red or blue. The centre and largest line of the border is usually a zigzag design on a black or brown ground. The inside line is white, like the line next to the outer edge.

Under the name of Daghestan are included the makes of several districts in or near the Caucasus Mountains, and also some other rugs in which the patterns and fabric are somewhat similar. Like the Turkish goods, the Daghestans are of much coarser weave than the Persians, and the designs are composed of geometrical figures. Crookedness is another common feature, and many good patterns are spoiled by this defect. Daghestans are not high priced as a rule. They come frequently in long strips, and are therefore well suited for halls, but the strips are liable to be curved or otherwise unsymmetrical, and even the small pieces are often much broader at one end than at the other.

Among the makes which are frequently classed with Daghestans are Karabaghs, Kazaks, Shirvans, Cabistans, Sumacs and Guenges. Neither Karabaghs nor Kazaks ever come in carpet sizes. Khivas and Bokharas are not made in Daghestan or near it, but they are made in Russian territory, and in the Constantinople market they are often classed with the products of Daghestan or

the Caucasus districts. Karabagh rugs have a silky woof and are closely sheared. The centres are light colored and the borders are often of camel's hair. Cabistan is the name used for Daghestans when the goods are made in carpet sizes.

Fine Karabaghs are remarkable for beautiful combinations of colors, especially in the blending of reds, olives



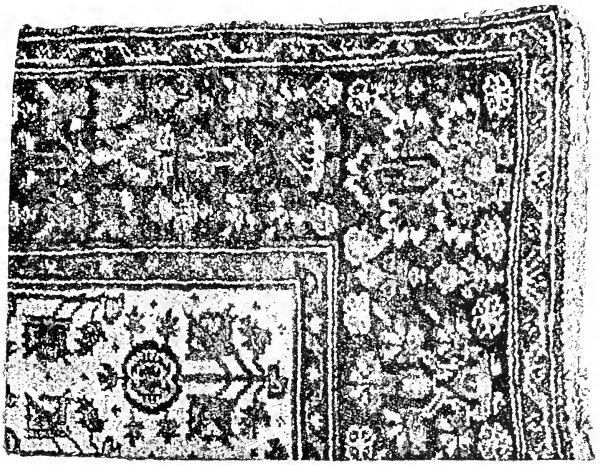
CAMEL'S HAIR CARPET.

and blues. The nap is generally heavy and very glossy, and the designs, although characterized by large figures, are usually artistic as well as striking.

The coloring usually seen in antique and modern Daghestans is various shades of red, blue, yellow and white. The red changes with age to a beautiful pink or rose. The blue and yellow become richer or mellower as they grow older, and the white turns to ivory. A Daghestan

rug always has a fringe on one or both ends, the warp being carried out to make it, but a Kazak, besides being heavier than a Daghestan, has no fringe, the warp being twisted into a heavy cord or braid. This twisting draws the ends of the rug and makes it crooked. The colors of the Kazaks and Daghestans are generally the same, but white grounds are common in the latter and rare in Kazaks.

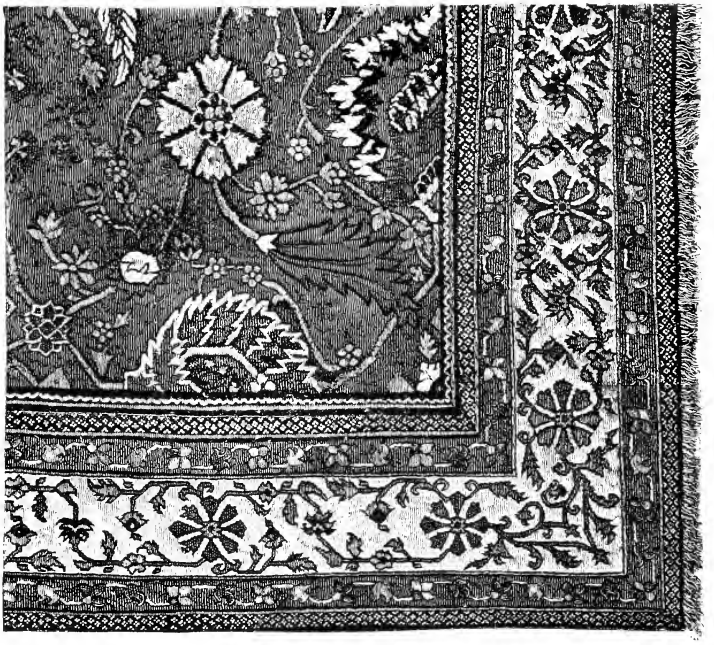
The Bokhara and Afghan rugs, although so often classed with Daghestans, differ from them in several respects.



KARABAGH CARPET.

The Afghans are always prayer rugs, and are as a rule softer in color than the Bokharas. The dominant color in both Afghans and Bokharas is red of various shades. The design is generally an arrangement of geometrical figures in lines running from end to end of the rug, and leaving only a few inches around the edges

for what is called the border. The figures are squared off with a fine black line running each way through the centre, and between the spaces are little figures in various tones of white, blue, green or yellow. The border, when it occurs at all, is made by two narrow rows of



INDIAN CARPET.

geometrical figures, like those in the centre of the rug, but much smaller. When made in sizes as large as 6x9 feet or larger the goods are called Khivas.

Persia has furnished the oldest and finest examples of

Oriental floor coverings. Among the best known makes classed as Persian are the Shirvan, Sennah, Kirman, Mossul, Cashmere or Soumac, Shiraz, Ferehan, Herati, Teheran, Khorassan, Kurdistan, Heraz, Khivas, Serebend, Djorzan, Savelan, Hamedan and Sedjades.

The Ferehan goods are made in both rugs and carpet sizes, in small, chintz designs, with dark blue grounds and reddish borders. They are not expensive and are well suited for dining reoms or libraries.

Most genuine Shiraz rugs are antique and are found in small sizes only. They are of closer weave than the Ferehans, and are much more varied in colorings.

Savelans resemble Ferehans, but are of finer weave. They come in large, bold designs and in a wide range of colorings. Most of the weavers of Savelans are under the control of European firms, and therefore any designs or colorings required can be supplied.

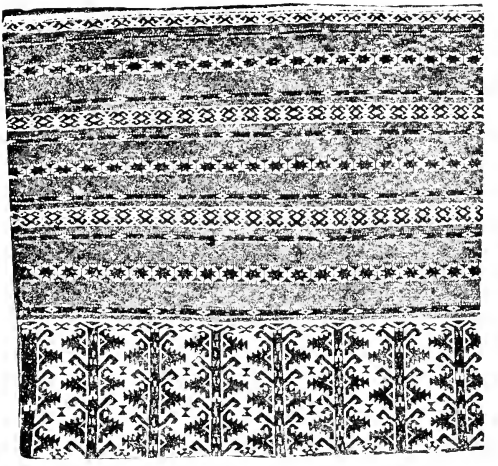
Cashmeres or Soumacs are often classed with the makes of the Caucasus, and a rug called Cashmere is also made in India. The Cashmere is woven without a woof and in large medallion designs. The ground is generally dark red. The antique specimens have admirable colorings, but the modern goods are often crude in this respect. A characteristic of many Cashmere rug designs is a figure representing an obelisk.

Hamedans rank among the least expensive of Persian makes, but they are both durable and handsome. They resemble the Heraz in pattern, having medallion centres, with conventional floral treatment, and borders in which the designs are also floral.

Sedjades, Kirmans and Sennahs rank among the choicest products of the Oriental looms. The Sedjades are largely used for wall hangings. Sennahs are woven closely

and have a short, silky pile of goat hair. The colorings are delicate opaline shades, suggesting sapphire, gold and rich ivory. The borders are generally in mosaic designs. These rugs are rarely found larger than 5x7 feet.

The weave of the Kirman rugs is especially close and fine. The pile is as lustrous as silk, especially in the antique specimens. The old gold and ivory grounds,



TURKOMAN CARPET.

characteristic of many of these rugs, are beautiful specimens of Oriental coloring.

Kurdistan rugs are closely woven, have a short, velvety pile, and are somewhat subdued in colorings.

Khorassans are of fine texture, and the floral designs, which are much used in them, are less conventional in treatment than is the case with most other Oriental patterns.

Khivas or Bokharas are made of thick fine wool, woven

very closely, and rank among the finest rugs made in the Orient. They come generally in two styles of designs, one being known as the round and the other as the temple. The ground is usually red, in various tints.

The rugs called Kelems are made in several provinces of Persia. They have patterns which are the same on both sides, and being of light and flexible texture they are used for portières and table and sofa covers, as well as for floor coverings. The designs are good and the colorings are brilliant.

The Namads or felt carpets of Persia are made by digging out a space in the earth as large and as deep as the size and thickness required for the carpet, and then filling the space with hair, which is beaten with mallets until it becomes a cohesive mass. A design of colored threads is beaten into the upper surface. The large size and weight of these carpets render them undesirable for export.

The special features of Persian designs are coiling tendril work, with indented leaf and palmetto-like blossom. These designs are often found in combination with figures of animals, flowering plants and trees.

The leading makes of East Indian carpets are the Pushmeina, Punjaub, Maharajah, Cabul, Cashmere, Candahar, Agra, Mirzapore, Amrister, Juipore and Marzuliptan.

The Pushmeina rugs are made of the finest wool, closely woven, and are both rare and expensive. The Agras are notable for heaviness, rigidity and stiffness. Rug making is carried on to a considerable extent in the jails of India, this kind of work being found well suited for the convicts of that country. There are also several large and successful factories controlled by foreign firms, but the industry has lost the prominence it enjoyed in the past.

CHAPTER V.

Savonnerie and Aubusson Carpets.

The French Savonnerie carpets are woven on high warp tapestry looms in the same factory at Paris in which the Gobelin tapestries are made; but the method of weaving them differs entirely from that employed in the making of Gobelin tapestries. Savonnerie carpets are, properly speaking, velvets. The warp is wound vertically on two cylinders, and arranged as in the tapestry loom, but the worsted threads composing the woof, which are to form the surface of the carpet, are fastened by a double knot on two threads of the warp, which is of wool and double, combining itself with the threads of the velvety surface, and also with a warp and weft, which do not appear on the outside. The weaver, while at his work, sees the right side of the fabric, not the other, as in the weaving of Gobelin tapestry.

To make the knot he takes a shuttle, separates with his left hand the thread of the warp on which he is to begin and draws it toward him; he then passes behind it the shuttle and the worsted thread, which he holds with his right hand, and then bringing forward the next thread of the warp makes a running knot around it, which he tightens. Between these two shoots the wool forms on the front of the warp a ring having a diameter in accordance with the height of the pile. The weaver then intersects the threads of the warp with another hempen thread, forming the weft. To do this he advances the threads which

are behind, passes the woof between the two rows of threads and allows those from the back to resume their former place. In this manner each of the knots is, as it were, linked together. The knots and hempen threads are then struck with the comb and forced inside the fabric so as to be invisible. Finally the carpet is clipped or shaved, this being necessary on account of the unequal length of the ends of wool left in cutting the loops of the pile. The clipping process requires much precision on the part of the workman and has an important bearing on the appearance of the carpet.

As Savonnerie carpets are larger than most pieces of Gobelin tapestry, the looms in which they are made are also larger, and allow several weavers to work on a carpet at the same time.

Aubusson carpets are made at the well-known tapestry factory at Aubusson, France. Only low warp looms are employed in this factory, while at the Gobelins only high warp looms are used. The Aubusson carpets differ from the tapestries of the same factory mainly in being of coarser and thinner weave.

In the low warp loom the cylinders, which are placed horizontally, are inserted in two wooden checks, which are supported by uprights. Around one of these cylinders is placed the warp, and the web, as it progresses, is rolled on the second cylinder. Two treadles are used to raise alternately each leaf of the warp. The workman seated on a bench placed in front of the loom, with his feet resting on the treadles, separates with his fingers the threads of the warp which he requires, and passes between the two leaves of the warp a broach, so called, which is mounted with wool. He regulates the courses with a reed and presses them down with a comb of wood or ivory.

In making the body the workman weaves the ground until he reaches the point where the figure begins. Having the design before him, he then inserts the yarns which go to make the figure, these yarns being hung near him so that he can take up each color as required. There are no repeats in an Aubusson centre design, the characteristic feature of such patterns being a medallion.

Savonnerie and Aubusson carpets being hand made and of fine material, rank among the most expensive of floor coverings. The demand for them is comparatively small, especially in the United States, where a heavy import duty is added to the high cost of manufacture.

CHAPTER VI.

Hand Made and Chenille Axminsters.

Old-style hand made Axminsters were first manufactured by Thomas Whitty, who established a factory for the purpose at Axminster, England, in 1755. When Mr. Whitty failed in business some years later the industry was transferred to Wilton, where a factory for the manufacture of the goods is still in operation.

In 1833 James Templeton, a manufacturer of chenille shawls at Paisley, Scotland, conceived the idea that the process of making these shawls might be applied in the manufacture of Axminster carpets, and this was the origin of the Templeton Chenille Axminsters, which are now produced in the factory of Templeton & Co., Glasgow, Scotland. This firm are also extensive manufacturers of machine made Axminsters.

In the weaving of the old-fashioned hand made Axminsters the carpet is made in one piece on a loom which consists substantially of a large wooden roller or winch, about 2 feet 6 inches in diameter and some 20 feet long, pinned at the ends to two uprights. These uprights are joined together by a beam some 4 or 5 feet above the roller, and of course parallel to it. The long warp threads of the carpet are passed over this beam and separated from one another by little pins or studs in the beam. The strong linen threads comprising this warp are fixed to the roller at one end, the other end being also secured.

The girls who do the weaving sit beside one another on a long bench in front of the loom, each girl having a certain width of carpet to weave. She has first to fix the pile to the warp strands, and then to weave the strands into a solid backing.

Beside her, so that her left hand can reach them, hang a number of short lengths of wool of various colors. In front of her is pinned the colored paper pattern which she is to reproduce in the carpet. Guided by her pattern she takes the appropriate piece of wool, ties it tightly on to the warp strand, and then, with a pair of scissors, snips off the two ends of the knot within about an inch of the strand. In this way the two woolen tufts are left standing out from the warp, and by placing a succession of them side by side the thick pile of the carpet is gradually built up. When one row of tufts is completed, a shuttle carrying strong threads is passed once backward and once forward between the strands, thus interweaving warp and tufts. Then comes another row of tufts, and the passing of the shuttle as before, and so on until the carpet is finished. Each tuft of the pile goes through to the very back of the carpet, so that real Axminster cannot become threadbare until it is worn entirely through.

The process of manufacture is slow, and the thick, heavy pile calls for a great amount of wool; consequently real Axminster carpets are extremely expensive. The demand for them, as with Aubusson and Savonnerie carpets, comes from quarters where more importance is attached to quality than to price—large and fashionable hotels, club houses, royal palaces, and houses of the rich. The floor coverings known as Berlin carpets are similar to Axminsters. They are made in Germany, and also at a factory in Morrisania, New York city.

In the machine made chenille Axminsters, the chenille is first woven so as to form a double fringe of colored yarn with a fine thread running along the centre to keep the thread lengths of wool taut. This fabric is then cut into strips, each of which is bound into a V-shape, so that the double fringe becomes a series of thick tufts of wool side by side and firmly held together by the binding thread. This chenille is then ready to serve as the weft of the carpet fabric, being laid across the warp threads and woven into place in the loom, a hand loom being used for all chenille Axminsters wider than 27 inches.

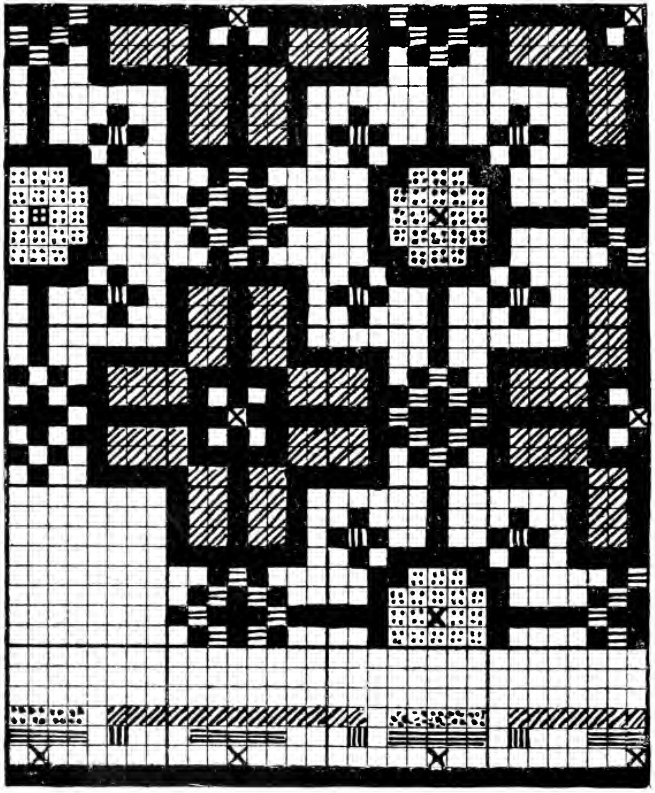
CHAPTER VII.

Body Brussels and Wiltons.

ODY BRUSSELS carpeting consists of a worsted yarn built upon a linen or cotton chain, and a linen weft. The worsted warp which forms the face of the carpet is wound on reels or bobbins arranged on large horizontal frames, which are placed one above the other in the rear of the loom. Each reel supplies one thread of worsted to the loom, and as there are 260 threads in the width of a Brussels carpet (27 inches), there are necessarily 260 reels on each frame. The loops which appear on the face of the fabric are made by the insertion of wires when the worsted warp has been raised by the operation of the Jacquard. These wires are withdrawn and inserted again at regular intervals as the weaving proceeds. The warp from each frame is drawn in a continuous web into the loom, and the Jacquard attachment above the looms controls every separate strand of the 1,000 to 1,500 which are being fed into the loom from all the frames. Each yarn is raised into the face of the carpet or dropped into the body according to the pattern on the Jacquard.

A Brussels carpet is called 5 frame when it is woven from five of the frames referred to, and if but four are used it is termed a 4 frame Brussels. It is obvious that if each of the frames is run with its full warp a 5 frame carpet will contain 25 per cent. more wool than a 4 frame. The number of frames used never exceeds six, and if

each contributed but a single color to the warp the greatest number of colors possible would be six. But some Body Brussels contain as many as twenty-five or thirty colors



a

this variety being obtained by "planting" warps of different colors on the same frame. But it is evident that the number of colors in any perfectly straight line running lengthwise in the carpet cannot be greater than the actual

number of frames. Modifications of color lengthwise can be obtained only by dropping the warp of one frame and picking up the corresponding warp of another.

If a color—as, for example, blue—appears only in spots or in small masses of any kind, and these are separated from each other by some distance in the width of the carpet, it is then obvious that this color does not go all over; but if certain colors recur constantly throughout the entire width of the fabric, then the number of these will show how many frames or thicknesses of worsted are in the carpet.

In the diagram presented herewith, which represents a ruled paper drawing of a six color, four frame Brussels carpet, the diagonal lines indicate one color, the dots another, the vertical lines another, the horizontal lines another, the white spaces another and the black another, while by a glance at the gamut *a* it will be seen that but four thicknesses of yarns are necessary for weaving this pattern, the yarns being of six colors. Frames 1 and 2, counting from the top, are "planted"; that is, each of them contains more than one color, and the first three frames are also imperfect. Thus in the top frame one stitch out of every ten is omitted, or twenty-six in the entire width of 260 threads; in the next frame four are saved out of every ten, or 104 in the width, and in the third frame one is saved out of every ten, or twenty-six in the width. The fourth frame alone is complete.

Wilton carpets are woven just as Brussels are, excepting that the wires used in making Wiltons have a sharp blade attached, and so arranged that when they are drawn out the blades cut the loops open, and thus form a plush surface. The pile of a Wilton carpet is higher than the loops of a Brussels, about 50 per cent. more yarn being used for Wiltons.

CHAPTER VIII.

Tapestry-Brussels and Velvet Carpeting.

THE salient feature of the manufacture of Tapestry or Tapestry Brussels, and Velvet carpeting is the printing of the pattern on the yarn warp, thread by thread, before the carpet itself is woven on the loom. The pattern is drawn and colored on rule paper, just as the Body Brussels pattern is laid out. Some years ago it was customary to elongate the drawing in order to allow for the loops on the surface of the finished fabric, but this method is not necessary now.

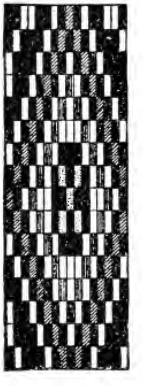


FIG. 1.

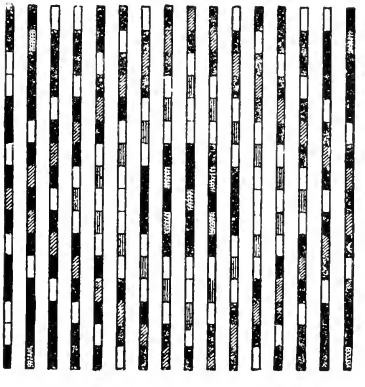


FIG. 2.

Next comes the first distinctive step in Tapestry making, which is the cutting of the rule paper pattern lengthwise into several oblong strips, one of which is shown in Fig. 1 of the engravings presented herewith. This strip represents consecutive threads which run lengthwise through the entire piece of carpet, and for the sake of clearness in this

description, these strips are shown again, separated from each other as in Fig. 2 The number of warp threads in a width (27 inches) of Tapestry carpeting varies from about 180 in the low grades to 216 in ten wire goods. Each strip of pattern paper is placed on an oblong board, and when the dyeing of the threads represented on it is to begin the board is taken to the printing drum. These drums vary in diameter in accordance with the length of the pattern, or sometimes the number of repeats in it. The drum is first covered with an oil cloth, which is in turn covered with white yarn, wound around it as closely as the thread on an ordinary reel of cotton. The drum revolves on its axis and the man who guides its movement has hung before him for reference one of the oblong strips of the pattern previously mentioned. Each of the various threads represented on the strip is designated by a number, and every color which appears

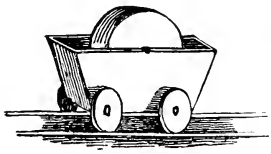


FIG. 3.

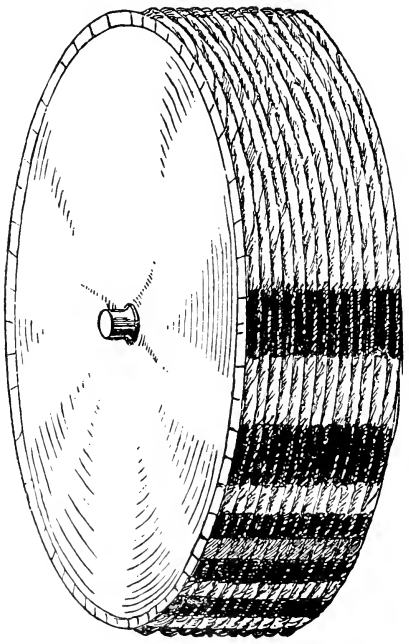


FIG. 4.

in the pattern has also a number. The drum also bears near its edge a series of numbers and is provided with a ratchet arrangement which enables the operator to guide the revolution of the drum in accordance with the ruled squares of color upon the design. Underneath the drum is a small carriage running on rails, and in this carriage, which contains a quantity of dye, a wheel revolves as shown in Fig. 3, the top of the wheel being just high enough to touch the thread on the drum, and thus cover it with dye. The printer, referring to his pattern, sees the color needed for, say, the first square in it, and the carriage is then passed along the rails, so that the color required is printed or ruled across the thread. During this operation the drum is held in place by the ratchets, its revolution and the movement of the carriage beneath being regulated by the printer's comparison of the index on the drum with the numbers on the print board.

The width of the dyed portion of the thread does not correspond exactly with the square or squares of the pattern, some allowance being made for the fact that the fabric will be woven in loops like Body Brussels. As has been said, the loops were formerly provided for by elongating the design, but this had disadvantages, and most manufacturers now make the movement of the drum answer instead, some allowance being also made for the stretching of the yarn when the loops are formed. Fig. 4 represents the drum with the yarn wound around it, the dark stripes showing where the dye has been applied.

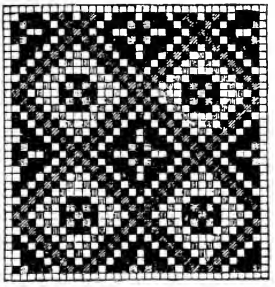


FIG. 5.

The printing of the yarn on the drum is continued in the way described until all the colors needed for the particular thread which covers it have been applied. It was formerly the custom for the printer to scrape the yarn with his fingers to remove superfluous dye, but this operation is now performed much better by a mechanical scraping device, in which a rubber substitute for a finger follows the dyeing wheel in its passage across the thread.

The dyed yarn, all of which forms but a single thread in a piece of carpeting, is then removed from the drum to the steaming room, where it remains long enough to fix the colors firmly, and is then allowed to dry. From the drying room it passes to the reeling machine, which winds it on a spool, and it is then ready for the setters, whose work consists in setting side by side all the pattern warp threads which are to appear in the carpet when it is finished. At one end of the setting machine are arranged the reels or bobbins of thread, every thread in the width of the carpet being wound on its particular bobbin, the number of bobbins running of course from 180 to 216. The thread on each bobbin is pulled out and fastened to a roller at the other end of the machine. The roller is then run out to a certain length, the threads being thus drawn taut side by side, like the strings of a piano, but touching each other. Two girls, one standing at each side of the machine, then take each thread separately and move it to its proper place, as it appears in a somewhat elongated copy of the pattern, which is placed on the machine underneath the threads. As a certain portion of the threads is passed it is wound on the roller at the other end, and when the setting process is completed the yarn on this roller is ready to be woven in the loom. Fig. 5 shows the pattern as it appears in the finished carpet.

Tapestry carpeting has a backing of jute yarn, a cotton chain, and a linen or cotton weft, which serves as a binding thread for the loops, these being made over wires as in the weaving of Body Brussels. Until recently all Tapestry looms have been subject to a serious defect, in the liability of the printed warp to run unevenly in relation to the ground warp. When this trouble occurs the successive "blocks" of the pattern are too long or short, and do not register accurately with successive portions of the warp strands so as to secure uniformity in the appearance of breadths, and the matching of the pattern in successive breadths when placed side by side. This difficulty has been overcome by a recent invention which insures the accurate registry of the pattern blocks with the other portions of the body fabric, any irregularity which occurs being corrected by the automatic action of an ingenious mechanism by which the tension on the warp yarns is increased or diminished as may be necessary. This device not only removes the danger of weaving unmatchable goods, but also enables one operative to run two looms instead of one, thus doubling or almost doubling the capacity of the Tapestry loom.

Velvet carpeting is the same as Tapestry Brussels, excepting that the wire used in the weaving has a knife-like edge which cuts open the loops as it is withdrawn and forms a pile surface as in Wilton carpeting. Velvet carpets also resemble Wiltons in the fact that more yarn is used for the pile than is considered necessary when the loops are not to be cut as in Body Brussels.

CHAPTER IX.

Printed Tapestry Carpeting.

The making of Tapestry Brussels by the method which has been described enables the manufacturer to produce handsome carpeting at a low cost, but the dyeing of the yarn is a delicate operation and the process of manufacture throughout requires much skill and care and the investment of a large amount of capital. For these and other reasons many attempts have been made to simplify the process and to reduce still further the cost of manufacture, but among all the improvements put forward in this line of invention during the past forty years or more, the conception of James Dunlap, of Philadelphia, has proved the most successful.

In the process patented by Mr. Dunlap in 1891 the yarns are woven undyed, or dyed of a uniform basic color or tone, and they are woven like a Tapestry or Velvet carpet, that is, without a Jacquard machine. After the fabric is woven, with the pile cut or uncut, as desired, it is submitted to the action of a color printing machine somewhat similar to that which is used in calico printing, in which the fabric is wound on a large pressure drum or roller, and pattern rollers, one for each color and engraved to produce the design desired, revolve in contact with the face of the undyed carpet.

The idea of impressing a design upon an undyed carpet by means of block or roller printing devices was not a new one, but Mr. Dunlap's method of carrying it out was original and overcame an obstacle which had baffled all

previous inventors. This difficulty was caused by the fact that a pile carpet, cut or uncut, is a comparatively soft, yielding mass, which, to be perfectly dyed, must receive the color not only on the tips of the pile, but down to the very roots and even into the back. Moreover, the color must be so applied that the yielding or wearing of the pile in use will not distort the pattern. Great pressure must be employed to force the color into and through the fabric, and the dyeing matter must be used in considerable quantity, but not so as to fly or run laterally in the pile beyond the exact limits of the particular figure of the pattern being printed at that point.

In Mr. Dunlap's process the carpet fabric, after being woven undyed in an ordinary Tapestry loom, is prepared for the reception of the dyes by dampening its surface with a mixture of oil, vitriol and other ingredients. The fabric is then dried by running it over hot cylinders. For printing the carpet, the designs engraved upon the printing rollers are cut to a certain depth, and then further and deeper cuts are made in the form of cells or cups evenly distributed over the entire figure. These cups receive the heads of the pile and the great pressure with which the roller is applied forces the color into their very roots. After passing the fabric through the rollers steam is forced into and through it from both sides, in order to drive the dye into it and at the same time to raise the pile, which has been forced down by the pressure of the printing roller.

In June, 1896, Mr. Dunlap obtained an additional patent for certain improvements on his original process, by which the various steps in it which have been described are performed continuously and automatically, instead of being more or less independent of each other. This improve-

ment was accomplished by embracing in a single structure a printing mechanism, a steam chamber, a starching apparatus, a drying chamber and means for operating automatically and in concert the various parts of the structure.

CHAPTER X.

Moquettes and Machine Made Axminsters.

The carpeting which first bore the name of Moquette was practically the same as the Wilton fabric. In the United States Moquette is the name applied to a tufted pile machine-made carpeting first manufactured by Alexander Smith on a loom invented by Halcyon Skinner and patented in 1856. These American Moquettes are an imitation of a carpeting first made at Nimes, France. The French goods were made on a hand loom only, but Halcyon Skinner's invention rendered it possible to make them on power looms and so effect a great saving of the cost of manufacture. At the present time the name of Axminster is also used to designate carpeting which is practically the same as Moquette, differing mainly in the number of tufts of wool to the inch or in the manner of fastening the tufts more or less firmly in the fabric. In the Skinner Moquette loom the warp is composed of two parts mounted on separate beams and comprising threads of different grades of fineness, the warp of coarser threads being under greater tension than the other so as to be kept straight as possible, that of the finer thread being under less tension, so as to be bent around the woolen pile tufts and the weft threads. The straight or coarse warp is subdivided into two parts, one being called the tufting warp because the tufts are secured to it, and the other the body warp because it gives firmness to the fabric. The pile con-

sists of a succession of the tufts of yarn referred to, extending across the fabric, with the ends standing upward. To carry the yarns which form the tufts spools about as long as the width of the fabric are employed, the number of spools composing the series being equal to the number of ranges of tufts required to complete the pattern desired. The yarns are wound on each spool with such an arrangement of colors as may be required by the part of the figure supplied by that spool. The spools are mounted in succession on the links of a pair of endless chains which move in unison and with a positive motion, to bring each spool in succession to the position for introducing one range of tufts into the fabric. The journals of the spools work in a frame which engages with the links of the chain by means of spring clips.

In beginning the weaving, the mechanism of the loom detaches the first of the series of spools with its frame from the chains and carries it down in front of the lay just over the tufting warps. The tufting yarn is then grasped by a series of nippers, drawn out and carried around the pairs of tufting warps, these nippers being mechanical substitutes for the Oriental weaver's fingers in his hand loom. The heddles are then operated so as to hold the tufts in position while the nippers let go their hold and two steel blades then cut the tufting from the several parcels in the spools. The tufts are then woven into the body of the fabric, thus completing one row of tufts in the fabric. This operation is repeated for the next row and so on continuously.

Since Halcyon Skinner's loom was first put into use many changes have been made in both the mechanism of the loom and the fabric manufactured on it, but the essential features of the weaving process remain as here described.

CHAPTER XI.

SMYRNA RUGS.

SMYRNA rug is simply a chenille Axminster fabric with the wool distributed on both sides, instead of only on the face. The goods were at first a by-product of the factory of the Messrs. Templeton at Glasgow. This firm were the original manufacturers of the chenille Axminster carpeting, and from the waste chenille they made what they called an Afghan rug, which had a double instead of a single face. The goods were woven only in hit or miss or mottled patterns, and the Oriental and other effects now the prevailing styles in these rugs originated in this country.

The double faced chenille fabric was first made by European manufacturers of shawls, and it was these shawls which suggested to carpet manufacturers the idea of making a floor covering of the same material.

Robert Beattie & Sons were pioneers in the manufacture of Smyrna rugs in this country. They were perhaps the earliest manufacturers of them, and they were certainly the first to make them in any considerable quantity. They made them at first by sewing together breadths of chenille carpeting, and sewing on a border, which was woven with separate corner pieces to avoid mitering. The goods were made in one size, 6x9 feet, and sold as "Turkistan" carpets. Most of them were bought by Joseph Wild & Co., and it was this firm that suggested to the

Messrs. Beattie the idea of reproducing Oriental patterns, a Ghiordes rug being selected as the first to be copied.

Sheppard Knapp, of Sheppard Knapp & Co., believes that Job Pearson made the first piece of chenille carpet in this country. Mr. Knapp advised Pearson to put a border on the carpeting, and thus produce an imitation of an Oriental rug. Mr. Knapp was the first to advertise these goods as "Smyrnas," and at his suggestion application was made for a patent on them, but for some reason it was refused.

Since the starting of the industry in this country, which was about twenty years ago, many important improvements have been made in the process of manufacture. In the factory of to-day the dyed yarn is first taken to the cop winding machine and wound on cops, which then go to the weft weaving room. The pattern which is to be reproduced in the weft is drawn and colored upon the design paper in the usual manner, but is then cut into strips, which are called papers. Each strip is a double paper, each paper representing one shot in the setting loom.

The operative at the weft weaving loom begins her work by placing one of these strips before her as her guide in throwing the shuttles containing the weft yarns. The warp yarn is composed of four cotton threads, but by the movement of a cam in the loom these are twisted in the weaving operation so as to make two double threads instead of four single ones. When the pattern on the first strip has been reproduced in the weft the weaver takes the strip which comes next in order in the design, and continues in this way until the entire pattern has been woven. The chenille, which during the weaving operation has been wound on a beam, is then taken to the cutting machine, in which a number of small circular blades

fixed on a revolving cylinder come in contact with the chenille as it passes over another cylinder and cut it into narrow strips. As quickly as it is cut the twisted threads in each strip cause it to twist itself into the fur-like shape characteristic of chenille fabric. The strips after passing through the cutting machine are wound on cops, and are then ready for the setting loom, in which the warp is cotton thread and the chenille fur is the weft, with a shot of jute yarn between each strip as filling. From this loom it emerges in the form of rugs, the pattern on the design paper being exactly reproduced in the woven rug. From the loom the rug goes to the shearing machine, where the surface is made even, and it is then fringed and finished. The fringing operation formerly required a great deal of hand labor, but all or nearly all of this work is now done by machines.

CHAPTER XII.

Ingrain, Venetian and Wool Dutch Carpets.

INGRAIN is a fabric composed of two webs or plies of cloth.

In weaving Ingrain each ply has its particular color, as, for instance, a two-ply carpet may have one ply of green yarn and the other of red. If the red ply forms the ground color of the design, then the green ply will be the figure color, and wherever the green yarn appears over the red ply that is ingraining. Two-tone carpets are used, as a rule, for churches only. The more general this ingraining or mixing up of the two plies, the more durable the fabric will be. A skillful designer will always mix his plies as closely as possible to avoid "pockets." The plies are of equal texture and are united at the edges by the selvage threads.

In weaving Ingrain the warp threads are moved by the Jacquard. For a two-color effect the filling threads are thrown by the shuttle from right to left and then about or back again.

In the shotabout ply two or more shuttles are used. When both plies are shuttled with two colors each, the weave is called a double shotabout. In a plain Ingrain each ply has but one color. In a plain and shotabout weave, one ply is plain and the other is a shotabout ply composed of threads of two or more different colors alternating, as, for instance, green and white, giving the effect of three colors in the carpet. In double shotabout each ply is a shotabout one, giv-

ing a design in four colors, say, black, red, green and white. Until the invention of the mate thread weave two dark threads could not be brought up together in a carpet, it being necessary to bring a light one up with a dark thread or vice versa. The mate thread device, by enabling the weaver to bring up either light or dark threads together, makes four-color effects possible.

In the old style Kidderminster Ingrain the warp yarns were three-thread worsted, but in the modern goods two-thread yarn is generally used, because this makes a saving in the most expensive material used in the carpet, and, moreover, the finer the warp yarn the more scope there is for shading in the weft colors.

Venetian carpets are made with a worsted or cotton warp and a jute filling. The warp is colored and makes the figure effect. In the weaving a Jacquard is used, but it is much less complicated than the one employed for Ingrain carpets. Venetians are used only for stairs and halls.

Wool Dutch carpets are not used now. They have a heavy warp and a thick single filling. The warp is woven in so as to form stripes, making what is called a Dutch plaid pattern. The Jacquard employed is of a very simple kind, having but one card and resembling that which is used for weaving plain Ingrain filling.

CHAPTER XIII.

Straw Matting.

THE straw matting which comes from China is manufactured from a species of reed or grass having culms which grow as high as 6 feet. When it has acquired the proper height the grass is cut, spread out in the open air to dry, then roughly sorted, packed in bales and delivered to the matting manufacturer, who sorts it again according to its fineness, uniformity and color. The freshest, greenest looking straw is taken for white matting, and the rest is put aside to be dyed. In the familiar red and white check matting the red color is given by sapanwood. For all other colors aniline dyes are used.

In Japan the matting manufacturers use a straw, like the Chinese, from which they make what is called the Bungo weave, but a larger proportion of the matting which comes from China is made of straw which is smaller than the Chinese and this makes what is called the Bingo matting. This kind of straw is easier to manipulate and can be woven in designs much more elaborate and handsome than is possible with the Chinese reed, but it is not so durable.

In both China and Japan the loom on which the matting is woven is of the same pattern, consisting merely of an upright bamboo framework with cylindrical crosspieces above and below, over which the warp runs, the woof being woven in without a shuttle. The movement of the warp is governed by the weaving beam or bar, a piece of wood 2 inches square and about a foot longer than the width of the matting which is to be woven. The bar is pierced with thirty-nine small holes, to receive the warp threads, the front row of holes being about three-sixteenths of an inch to the right or left of those on the opposite face, through which the other row of warp is threaded. The warp threads are made of hemp, and are oiled to make them smooth. When the warp become loose it is tightened by driving wedges between the upright and crosspieces of the loom.

The weaver handles his bar by means of a peg inserted midway in it. With this peg held at a right angle to the weave the warps are in normal position. When the peg is turned up the front row of warp threads moves back, and when the movement of the peg is reversed the back row of threads moves forward. Between each upward and downward turn of the bar the weaver's assistant, who kneels at his right with bundles of straw for the woof on the ground before him, draws from a bundle a straw of the color called for by the pattern, catches it in a notch cut in the end of a slender piece of bamboo about 4 feet in length, and holding the straw in this way places it horizontally between the two rows of warp threads. The weaver seizes the end of the straw, which passes beyond the left hand selvage and twists it around the selvage cord, while the assistant twists the right hand end in the same way. Then the beam is brought down with sufficient force, to press the warp straws closely together.

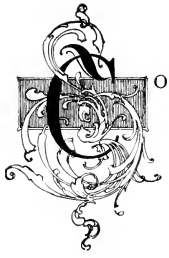
When the loom has woven a piece of matting 2, 4 or 5 yards in length the selvage is cut down clean with a knife, and the matting or mat is taken off the loom, which is then provided with another warp. As the straw is always wet before the weaving, the woven pieces are dried in the sun or over slow burning wood fires. To make the ordinary roll of matting a number of these pieces sufficient to measure altogether 40 yards are joined, this being done by running the warp ends of each two pieces in opposite directions under the woof, a smooth, flat bamboo needle being used for this purpose. The roll is then ready for packing.

Jointless matting is made on a loom which differs but slightly from that which is used in making the joined goods, the only change consisting in arrangements for loosening the warp and pulling it over whenever about 2 yards of the matting have been woven, the finished part being passed back under the loom. As the beam cannot beat up the woof so closely with this arrangement the texture of the jointless goods is quite loose.

To remedy this the roll is made somewhat longer than 40 yards, and is then stretched tightly over a tall box-like structure, open at the top, and containing in its centre a charcoal fire. Two coolies, one standing at one selvage of the roll, the other at the opposite selvage, then apply their hands to both sides of the matting, loosening and then forcing down the straw to the firmness desired. While this raking, as it is called, is going on the heat from the charcoal fire is removing the moisture from the matting.

CHAPTER XIV.

Cocoa Matting.



Cocoa or coir matting is made from the fibrous rind or husk of the cocoanut. The cocoanut palm tree, which produces these nuts, is cultivated in Ceylon, the Malabar coast, the Straits Settlements, the islands of the Eastern Archipelago, the West Indies, Central America, Brazil, and Zanzibar, Africa.

The husk, which contains the fibres, is removed from the nut by pressing it upon the point of a sharp spike of iron or hard wood fixed in the ground. The husks are then placed in soaking tanks, which are filled with fresh water. If the trees are on or near the seashore, the nuts are simply buried in holes dug in the sand, so that the salt water may reach and macerate them. The soaking renders the fibres more pliable and facilitates their separation from the cellular tissue of the husk. This is accomplished by beating the macerated husks with hard wooden clubs or mallets.

The fibre, or coir, as it is called, is then arranged in loose rovings or sheaves, which are twisted into yarn by being rolled in a peculiar manner between the palms of the hands. All these operations are performed by the natives in the countries where the cocoanut palm tree grows. The separation of the fibre from the nut and the twisting of the yarn, occupy them through the rainy season, when no other work can be done. The cost of native labor is so low and the yarn spun by machinery is so much inferior to the hand-

made product that all attempts to introduce machines in this work have proved impracticable.

The first process to which the yarn is subjected in the matting factory is bleaching, and, as all the skeins are not of equal texture and do not have the same color after bleaching, they are sorted according to shade or tint and texture.

The yarn intended for the warp is reeled upon bobbins about a foot in length, and these are placed on a frame at the back of the matting loom. Each thread passes separately through a reed, which keeps it in place, and then between a pair of iron rollers with roughened surfaces, which hold it tightly. The woven fabric also passes between a similar pair of rollers, whose purpose is to give the tension desired. The shuttle used is quite large, and the yarn for the filling is wound on a cob large enough to fit tightly in the shuttle. No spindle is used and the yarn unwinds from the end.

The matting loom is operated by power, and, unlike most other kinds of power looms, it requires constant and arduous labor to make it weave properly. This is owing to the difficulty in giving the necessary tension to the weft threads. The yarn is so coarse and harsh that every contrivance for tightening the weft sufficiently for a perfect selvage tends to interfere seriously with the working of the shuttle. The workman is therefore obliged to catch the thread behind the shuttle every time it passes through and draw it tight, an operation which considerably retards the speed of the loom.

Ordinary cocoanut matting is woven with a certain kind of twill in a three-leaved harness, two extra threads running in special loops, alternating up and down for selvage. In Calcutta-made matting this twill is reversed every five or six inches, so as to give the fabric a striped appearance. But all goods having this appearance do not come from Calcutta, for the American manufacturers produce the same ef-

fect by reversing the order in which the warp threads are drawn into the harness.

The looms on which cocoa mats are made are like an old-fashioned hand loom of the most primitive style; but they are very strong and substantial, as great tension is needed and heavy blows must be dealt with the lathe to beat the filling up tightly. The warp is wound upon the beam in the ordinary manner and passes through a plain two-leaved harness.

In making fibre mats the workman uses the loose cocoanut fibre, having first run it through a picker. He springs the harness, and twisting a bunch of the fibre into a wisp or loose strand, passes the end of it under each alternate warp thread as it is brought uppermost by the harness, cutting off each time a length sufficient to form the pile of the mat. The loose ends which are too short to be fastened in are pulled out. After a tuft of fibre is thus placed under each warp thread across the loom, the harness is sprung about and a weft thread run through as a binder. In the better grades of mats Zanzibar yarn is used for the weft. In cheaper goods remnants or short ends are employed. The harness is then sprung again and the process of inserting fibre is repeated. When the mat is woven to the size desired the warp is set forward some inches, leaving a number of bare threads. The mats are finally cut apart, finished on the edges with braid and sheared on the surface by a machine resembling a cloth shearer.

Coir mats are made in a similar manner, but, instead of loose fibre, the weaver has a large ball of yarn from which he forms the tufts. The weaving requires less time than it does for a fibre mat. The weaver, after springing the harness, passes the end of the yarn through from one side, while from the other, on top of the warp, he pushes forward a flat

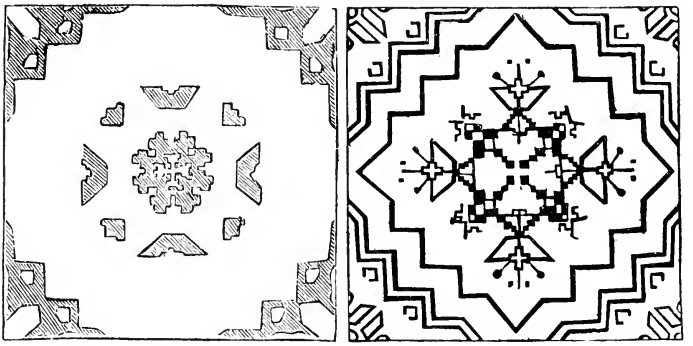
iron rod, grooved on the edge, upon which he winds the yarn, bringing up the loops between successive warp threads while pushing the rod along. When the yarn is thus wound across the warp a straight thread is run through for a binder, the rod is turned, with the groove uppermost, and the threads are cut by running a knife along the groove. The harness is then changed, the filling well beaten up with the lathe and the operation of winding the yarn on the rod repeated as before.

CHAPTER XV.

Floor Oil Cloth.

In the manufacture of floor oil cloth the first step is the preparation of the foundation, which is composed of jute burlap.

It is necessary to size the foundation, and in making narrow oil cloths the sizing is done by drawing the burlap through troughs filled with liquid glue, rye flour, tapioca or varnish, the best among these different sizes being a matter of opinion among manufacturers. The burlap is



GREEN. BLACK.

drawn through the troughs by means of rollers, which press the surplus sizing out of the cloth as it passes between them.

The sized surface is then rubbed thoroughly with pieces of pumice stone, this operation being performed either by hand or by a simple mechanical arrangement, in which the "rubbers" are moved over the surface by steam power.

When the cloth has been rubbed smooth and even, it is

then covered with a mixture composed of ochre, linseed oil and benzine. In order to make this coating even and uniform in thickness the cloth is passed under an arrangement of metal blades which scrape off superfluous paint. The coating, when dry, is rubbed smooth with pumice-stone, and this process of coating and rubbing is performed several times, the number depending on the quality of the goods desired.

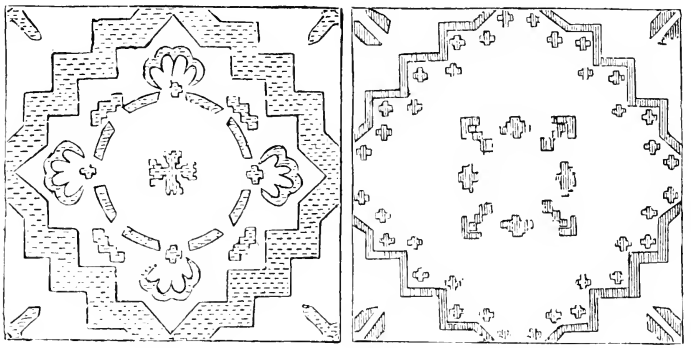
The printing of the pattern on the cloth, which is the next step in the process, was formerly done by hand entirely, but most manufacturers now use machinery for this purpose. In printing by machinery the cloth passes over a flat table, and under the printing blocks, which have a rising and falling motion. In the old manner of printing by hand the blocks were 18 inches square, and only this amount of surface was printed at one time with each block, but in the present method the blocks extend entirely across the cloth. The printing blocks are made of wood, and each color used in the pattern requires a separate block. The pattern is carved on the blocks in relief, the portions left uncut being those which form the design. The manner in which each separate block presents a surface exactly corresponding to one of the colors in the pattern is shown in the illustrations presented herewith, which represent a pattern with six colors and the six blocks used for it.

The colors employed are spread on the blocks by an arrangement of troughs and rollers. A roller revolving in a trough filled with coloring material passes across the face of a printing block, which then descends upon the cloth, makes its particular impression and rises again, each block printing its own separate color in this way until the pattern is complete.

When the printing is completed the cloth is taken to the

drying room, where artificial heat is employed to facilitate the drying. When sufficiently dry and hard the cloth is placed flat upon a platform, varnished, trimmed and rolled up ready for the market.

The blocks used for printing are made of the best white pine, thoroughly seasoned. They are about $1\frac{3}{4}$ inch thick and are faced with hard wood, usually maple, which is glued on. The face is generally creased by sawing fine parallel lines in one direction or both before the carving, as this facilitates the tracing of the design and the cutting away of



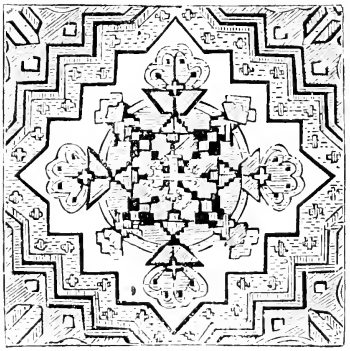
YELLOW. BLUE.

the superfluous wood. In order to get certain effects in the printing some parts of the design may be cut or punched in metal, these portions being then fastened to the faces of the blocks as required.

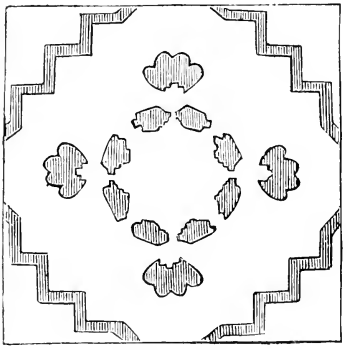
The pattern to be used is drawn and painted in full on paper, every color and part of the design being produced exactly as it is ultimately to appear. This design is then reproduced on the surfaces of the printing blocks, the number of these depending, as has been explained, upon the number of colors in the pattern. The part of the design

apportioned to each particular block is transferred to it by a tracing process, and the figure is then cut in relief as indicated by the tracing.

Besides the carved blocks, manufacturers use what are called pin-blocks. These are made in three pieces, to prevent warping, the pieces being securely cemented together. The middle one is of pine and the outer ones are of maple, the grain of these running at right angles to that of the inner piece. The printing surface is sawed across



COMBINED COLORS.



RED.

at close intervals in two directions at right angles to each other, and a surface thus produced composed of pins or pegs, the narrow interstices being regular and uniform. In preparing the block for its design all the pins not necessary for producing the figure desired are cut away.

The process of manufacturing sheet oil cloth differs somewhat from that which has been described, but the difference is simply in the manipulation of the cloth, the composition of the goods and general principles of manufacture being the same.

CHAPTER XVI.

LINOLEUM.

THE two main ingredients in the manufacture of linoleum are cork and linseed oil, to which are added smaller quantities of kauri gum, resin, and pigments of various kinds. In the manufacture of bottle corks about one-half of the cork is wasted, and this waste is the chief source of the cork for linoleum. The cork waste, after being freed from dust and other admixed substances by means of a sieve with a rapid reciprocating motion is crushed. This sounds very simple, but, as a matter of fact, the machinery required for the actual operation has to be of special character, on account of the elasticity of cork and the almost incredible rapidity with which it blunts the hardest steel knife edge. The breaker reduces the cork to pieces of about the size of a pea, in which state it is passed on to the grinding mill, which is like an ordinary flour mill, but with stones of lava, sandstone, or some other rough material. Cork dust being excessively light, quickly disseminates itself through the air of the mill; hence the utmost precautions have to be taken to prevent the explosive mixture of air and cork dust being set on fire. Even when the greatest care has been observed small explosions are sometimes caused by sparks from the machinery.

The next stage in the manufacture is the preparation of what is technically known as "cement," the chief ingredient of which is oxidized linseed oil. As everyone knows, oils are divisible into two classes, drying and non-drying oils, the

drying being brought about in the case of the first named by the absorption of oxygen from the air, and the consequent transformation of the oil into a solid resinous mass. For linoleum manufacture the linseed oil used must be of good quality, and great care must be taken in its treatment. The oil is first boiled, much as in the manufacture of paints and varnishes. The process of drying is facilitated by the addition of a small quantity of oxide of lead. The boiled oil, after being allowed to deposit any sediment in it in a settling tank, is pumped to the top of a high building and allowed to flow thence over a number of pieces of light cotton fabric, known as "scrim," which hang vertically from iron bars. The air of the building being heated to a temperature of about 100 degrees Fahrenheit, the layer of oil which adheres to the surface of the scrim becomes oxidized; that is, it solidifies, in the course of twenty-four hours.

This operation is repeated daily for six to eight weeks, until a sufficient number of solidified layers of oil are deposited on the cloth, the mass of oxidized oil having then a thickness of half an inch, and being termed "a skin." These skins are then cut down and ground between rollers.

To prepare the linoleum "cement" itself, the ground oil is mixed with resin and kauri gum until the whole mass is homogeneous. The cement and cork dust are then mixed together thoroughly, and if the linoleum is to be plain the coloring matter necessary is added at this stage. The mixture is then rolled upon a backing of jute burlap which passes between two cylinders to insure evenness and uniformity of thickness in the coating.

The printing of the pattern is the next step in the process, and there is no very material difference between the method of printing linoleum and that adopted for floor oil cloths.

The latest and most important improvement in linoleum

manufacture is the production of mosaic or inlaid goods, in which the colors do not appear on the surface only, but go through to the very back of the cloth.

Several patents have been granted in this country and abroad for methods of obtaining this result. In one process the linoleum cement having been made to a certain thickness, is cut into separate pieces by dies, and these pieces, shaped and colored to make the pattern desired, are then placed upon a burlap backing. Pressure is then applied to the mass until the canvas and coating are thoroughly united. After drying the backing is treated with a preparation of resin and other ingredients to make it waterproof, and the goods are then ready for the market.

In another process the linoleum mixture is in the form of a powder, which is dropped upon the jute backing so as to represent the designs and colors essential for the pattern, and the powdered mass is then subjected to heavy pressure from a heated plate until it is completely fused and firmly attached to the backing.

CHAPTER XVII.

Skin Rugs and Mats.

In the manufacture of sheepskin rugs and mats the first step is the salting of the pelts. As they come to the factory from the slaughter house they are piled up in layers, each layer being thickly salted. The room in which they are kept must be as cool as possible to avoid heating or sweating, which would quickly destroy the skins.

The soaking, which is the next process, is done in soft water, which in cold weather is slightly warmed. The skin must be softened thoroughly and the soaking necessary for this is done very carefully to prevent the loosening of the fleece at its roots. After soaking the skin twelve hours in the first water, this is replaced by fresh water, in which the skin is kept for twelve hours more. It is then placed over a beam or horse with the flesh upward, and stretched, scraped and scoured. The scraping is done with a dull iron tool similar to a large drawing knife, and in the cleaning soap, soda and water are used freely, but the soda must not be employed so much as to make the skin brittle. The cleaning process is finished by rinsing the skin thoroughly in clear water, and it is then hung on a horse to dry, but when the skin is to be dyed of certain colors it is first soaked in a strong lime bath to remove any traces of grease which may have remained after the scouring.

Dyeing sheepskins is a difficult operation, requiring great care. The wool must be dyed hot, and as the heated dye-stuff would spoil the leather if it came in contact with it, the wool side must be dipped in the dye so that a small space is left between the surface of the bath and the leather. In doing this a small part of the wool near the skin is not sub-

merged in the bath, but the fleece is nevertheless dyed to the roots, for the liquid color moves along or is drawn onto the very roots of the wool, and dyes the grain of the skin also. Skins with long fleeces are the best for dyeing, and for this reason winter skins are preferred.

It is next necessary to treat the flesh side of the skin by stretching it and closing up the pores. The skin is stretched upon a wooden frame similar to an old-fashioned quilting frame. Cords are attached at intervals to the edges of the skin, and the other ends of the cords are wound around pegs. By turning these pegs with a key the cords are tightened, and the skin is stretched lengthwise or laterally as desired. The pores are closed by the application of a solution of alum and salt to the flesh side. This serves also to tighten the roots of the fleece. While the solution is being applied, the skin is scraped with a tool made for this purpose, and the pressure caused by the scraping stretches the skin so much that frequent tightening of the pegs is necessary to keep it taut. When this process is finished the skin is semi-dried and the flesh side is then scraped, or shaved, with a keen-edged knife of peculiar shape. In the drying room, where the skin goes next, the back is pared and rubbed down with whiting, which absorbs any traces of grease which may still remain. The skin is then ready to be made into a mat or worked with others into a rug.

Our American sheep furnish the raw material for nearly all our sheepskin mats and rugs, but the Angora goatskin rugs and mats are made of imported skins.

Fine rugs are made from the skins of tigers, leopards, bears, foxes, wolves, dogs and other animals. The preparation of the pelts and heads for these rugs is a trade in itself. Tiger, bear and leopard skins make especially handsome rugs and are correspondingly costly.

CHAPTER XVIII.

The Principle of the Loom.

In the engravings presented herewith will be found a clear and simple illustration of the fundamental principle involved in the art of weaving.

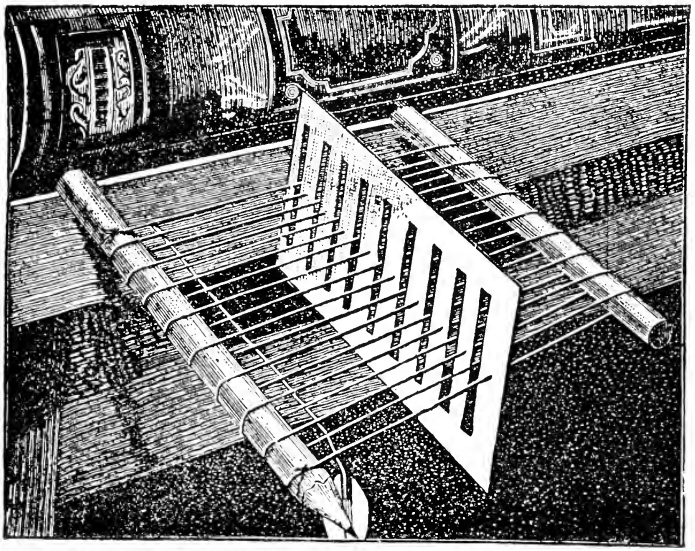


FIG. I.

The materials used in this object lesson consist, as shown in the engravings, of a piece of cardboard, two lead pencils, some thread and a heavy book to serve as a weight. The lead pencils are made to serve as the warp beams; the

heddle may be cut out of the card with a penknife, with which also a shuttle may be fashioned, as shown in Fig. 2. On the shuttle should be wound the thread that is to serve as the weft to be passed through the threads of the chain.

To rig up this improvised loom it is only necessary to place the two pencils on the edge of a table, held firmly in place by the weight of the book, as shown in Fig. 1. Now comes the operation of warping, which is done as follows: Fasten one end of the thread that is to form the warp chain

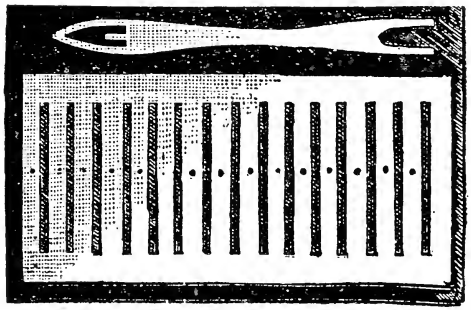


FIG. 2.

to one of the pencils, pass the other end through the first slit in the heddle, then around the other pencil and through the first aperture, then around the first pencil, and so on until the last slit in the heddle is reached.

The next step is the weaving. For this purpose the heddle should be raised and lowered alternately, while at each motion the shuttle carrying the weft is passed through the warp threads, one-half of which will be alternately lifted and lowered by the raising and lowering of the heddle. After each passage of the shuttle the weft thread may be pushed home to the web with the aid of a paper cutter.

CHAPTER XIX.

Carpet Cyclopedia.

Art Square—An Ingrain carpet woven in one piece.

Aubusson—A French carpet made on a tapestry hand loom. The warp is cotton and the weft consists of woolen yarns of the colors called for by the design. The weft yarns are inserted in the warp by hand, the weaver using a small bobbin or broach similar to that which is employed for Gobelin tapestry.

Axminster—1. A hand made carpet, having a warp of linen threads, with a pile of woolen tufts tied in by hand in Oriental fashion. 2. A carpet with a linen, cotton or jute warp and a chenille weft. 3. A machine-made carpet similar to an American Moquette.

Batten, Lay or Comb.—A swinging bar which beats up or forces closely together the weft yarns in the operation of weaving.

Beam—A round, horizontal part of a loom, on which the warp or the woven fabric is wound.

Bobbin—A spool carried by the shuttle and on which the weft or filling is wound.

Brussels—A carpet having a cotton or linen chain, a linen filling and a warp of colored worsted yarn, which is raised by the Jacquard machine into loops in the weaving to form the pattern.

Brussels, Tapestry—See Tapestry Carpets.

Brussels, Stouts—A Brussels carpet having only 208 or 216 ends of worsted warp to each frame instead of 256 ends, as in regular five frame Brussels. In weaving Stouts, jute yarn is used to replace the worsted yarn omitted, and also to give body to the fabric.

Chain—The warp threads of a fabric, the pattern chain.

Cloth Beam—The bar on which a fabric is wound as it is woven in the loom.

Color, Complementary—One of two colors which when combined produce white or nearly white light, as orange and blue.

Color, Primary—1. The principal colors into which white light is separated by a prism. 2. Those colors which when mixed (in pigments) produce any color, as red, blue, yellow.

Color, Secondary—Three colors, each of which is formed by mix-

ing two so-called primary colors, as green (blue and yellow), orange (red and yellow), and purple (red and blue).

COLOR, TERTIARY—A color such as olive, russet or citrine, produced by mixture of a primary and a secondary color.

COMB—See Batten.

COP—A conical roll of thread or yarn found on the spindle of a spinning machine.

COP TUBE—The tube on which the thread or yarn is wound.

DROP BOX—A box used in a figure weaving loom, to hold a number of shuttles, any one of which may be brought into operation as desired.

FILLING, WEFT, WOOF—The threads or yarns thrown by the shuttle through the warp from selvage to selvage.

GRANITE—An all cotton carpet, an adaptation of the damask weave, the pattern being formed by the warp instead of the filling.

HARNESS—An apparatus used for lifting threads in a loom.

HARNESS FRAME—An upright board for guiding the cords of a loom harness.

HARNESS SHAFT—A device for holding and guiding the heddles in a loom.

HECK—A vertical grated frame, through the meshes of which the warp threads pass.

HEDDLE OR HEALD—A series of vertical cords or wires, each of which has in the middle a loop or eye, which receives a warp thread. The heddles pass around and between parallel bars, forming part of the harness, and by rising and falling alternately cross the warp threads and form sheds for the passage of the shuttle.

HEMP CARPET—A fabric made with a jute warp and filling in two or more plies.

INGRAIN—A carpet made in two plies, the warp being worsted or cotton, with a wool filling.

JACQUARD—An apparatus used for weaving figure patterns. It consists of a chain of perforated cards, which move over a rotating prism. The perforations permit the passage of wires, which determine by their movements the raising of the warp threads, and thus cause the figure to be woven in accordance with the arrangement of the perforations.

JUTE INGRAIN—A carpet made like an Ingrain, but with a cotton warp and jute filling.

KIDDERMINSTER—An Ingrain carpet, so called because first manufactured largely at Kidderminster, England.

LAY—See Batten.

LOOM—A machine in which yarn or thread is woven into a fabric by the crossing of the warp or chain by other threads called the weft or filling.

MOQUETTE—1. A French pile carpet resembling a Wilton, but made on a hand loom. 2. An American pile carpet woven on a power loom which forms the pile by fastening tufts of woolen yarn into the warp.

ORIENTAL RUGS (AND CARPETS)—Goods woven in Eastern countries and made in one piece, usually with a linen or hemp warp and filling, and a pile consisting of tufts of colored wool, twisted around the warp by the weaver's fingers.

PATTERN CARD—The perforated card in a Jacquard apparatus, representing part of the pattern.

PATTERN CHAIN—A device for operating the shuttle in figure weaving.

PICK—1. The blow that drives a loom shuttle. 2. A unit of speed or measurement of work done by a loom.

PICKER STAFF (OR STICK)—A lever used to impart motion to a shuttle.

PRO-BRUSSELS—A carpet woven on an Ingrain loom but with both faces bound together. The warp threads are of jute, one-half of them being used for binding threads and the other half as a stuffer. The pattern is produced entirely by the interweaving of the weft, which is wool.

REED—This part of a loom consists of two horizontal bars, connected by thin parallel strips between which the warp threads pass. It is used to keep the threads separated from one another, and also to preserve the proper distance between the selvage threads.

SAVONNERIE—1. A French carpet woven in one piece on a high warp tapestry loom, the warp being of wool and the weft of worsted threads, which are fastened by a double knot on two threads of the warp. 2. An American carpet similar to the American Moquette or Axminster, but somewhat thicker and heavier.

SHADE—A color mixed with black.

SHUTTLE—A boat-shaped piece of wood which holds the bobbin from

which the weft thread or filling unwinds as the shuttle moves to and fro between the warp threads.

SHUTTLE-BOX—1. A case placed at the end of the shuttle-race to receive the shuttle after it has been thrown by the picker. 2. One of a series of compartments containing shuttles carrying different colored threads.

SHUTTLE-RACE—The track on which the shuttle travels in a loom.

SMYRNA CARPET OR RUG—A chenille Axminster fabric woven with two faces, the wool being on both sides instead of one. In the finished carpet or rug the warp is of cotton thread and the weft of chenille, with a thread of jute as filling between each strip of chenille.

TAPESTRY, OR TAPESTRY BRUSSELS—A carpet fabric in which the woolen warp forming the surface is dyed in the yarn in such a manner as to produce a pattern when woven. Tapestry carpets have a linen or cotton weft or binding thread and a jute yarn backing.

TEMPLE—An attachment to a loom which holds the last woven part of a fabric stretched to prevent chafing of the warp in weaving.

TINT—A color diluted with white.

VELVET—A Tapestry carpet in which the loops made by the pattern warp threads are cut, thus forming a velvety surface. Velvet carpets have about 25 per cent. more wool than is used for Tapestry Brussels.

VENETIAN—A carpet fabric having a worsted or cotton warp and a jute filling, the warp being colored and forming the figure.

WARP—The threads or yarn running lengthwise in a fabric, and between which the cross threads of weft or filling are woven.

WARP BEAM—The roller on which the warp is wound.

WEB—A textile fabric, a name used especially to designate a fabric in the piece or being woven in the loom.

WEFT, FILLING, WOOF—See Filling.

WEFT FORK—That part of the stop motion which causes the stoppage of the loom when a filling thread breaks or fails.

WILTON—A carpet made like Brussels carpeting, excepting that it has about 50 per cent. more wool, and that the loops on the face are cut so as to form a velvety surface.

WOOF, WEFT, FILLING—See Filling.

WOOL, DUTCH—A carpet having a heavy warp and a single thick filling, the warp being woven in so as to form stripes.

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